

Understanding Root Causes of Cost and Time Overruns in South African Mega Infrastructure Projects

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Abstract

This study investigates the root causes of cost overruns and schedule delays in South African mega infrastructure projects. Mega infrastructure projects are defined as large-scale developments valued at approximately US\$1 billion or more, characterised by high complexity, multiple stakeholders, and significant socio-economic impact. A qualitative research approach was adopted, using semi-structured interviews with six purposively selected industry experts possessing extensive experience in the planning, management, and delivery of South African megaprojects. Data were analysed using thematic analysis. The findings reveal that corruption, poor front-end planning, optimism bias, incomplete design and contract documentation, and inadequate project management capacity are the primary causes of cost overruns and project delays. Although these factors have been identified in international studies, the findings suggest that governance weaknesses, institutional constraints, and accountability challenges are particularly influential within the South African construction sector. The study is theoretically grounded in Agency Theory and Optimism Bias Theory, providing insight into how governance failures and unrealistic planning assumptions contribute to project underperformance. The research contributes to the limited body of knowledge on megaproject delivery in developing countries. It offers practical recommendations for policymakers, infrastructure clients, consultants, and project managers to improve project performance and infrastructure delivery outcomes in South Africa.

Keywords: MegaProjects, Cost overruns, Project Delay, Infrastructure Projects, Infrastructure Delivery

1. Introduction

Megaprojects are large-scale, complex infrastructure developments typically valued at US\$1 billion or more and characterised by significant technical complexity, long implementation periods, multiple stakeholders, and substantial socio-economic impacts (Flyvbjerg, 2014). Governments and policymakers often promote megaprojects as catalysts for economic growth, employment creation, regional development, and improved infrastructure provision. Beyond addressing infrastructure deficits, these projects are expected to generate long-term economic and social benefits through enhanced connectivity, increased productivity, and improved quality of life (Ansar et al., 2016). Despite their anticipated benefits, megaprojects have a well-documented history of cost overruns and schedule delays. Flyvbjerg (2014) argues that cost overruns and delays are not exceptional occurrences but rather common characteristics of megaproject delivery worldwide. Similarly, Plotch (2015) identifies schedule delays and budget overruns as among the most significant risks affecting the successful delivery of megaprojects. Given their scale and complexity, megaprojects require substantial financial, technical, and managerial resources, making

them particularly vulnerable to planning failures, stakeholder conflicts, design changes, and governance challenges.

The financing of megaprojects presents an additional layer of complexity. Due to their enormous capital requirements, megaprojects frequently rely on multiple funding sources, including government allocations, development finance institutions, public-private partnerships, and international lenders (Sergeeva and Ninan, 2023). Such arrangements often increase project complexity and expose projects to financial, institutional, and political risks. These challenges may be more pronounced in developing countries, where institutional capacity constraints, governance weaknesses, and funding limitations can adversely affect project performance (Othman, 2013). Existing literature has extensively examined the causes of cost overruns and schedule delays in developed economies, identifying factors such as optimism bias, strategic misrepresentation, inadequate risk assessment, scope changes, and poor project governance as key contributors (Flyvbjerg, 2009; Cantarelli et al., 2012). However, the extent to which these factors apply to developing-country contexts remains insufficiently understood. Scholars have argued that contextual

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factors such as corruption, political interference, procurement inefficiencies, skills shortages, and institutional weaknesses may play a more significant role in developing countries than in developed economies (Mahamid, 2017; Amoatey and Ankrh, 2017).

South Africa presents a particularly important context for investigating megaproject performance. As one of Africa's largest economies, the country has invested heavily in large-scale infrastructure programmes aimed at supporting economic growth, improving service delivery, and addressing historical infrastructure backlogs. However, several major infrastructure projects have experienced substantial cost overruns and schedule delays, raising concerns regarding project governance, planning effectiveness, and implementation capacity. Despite the growing importance of megaprojects in South Africa, empirical studies focusing specifically on the causes of cost overruns and delays in South African megaprojects remain limited.

This study addresses this gap by investigating the factors contributing to cost overruns and schedule delays in South African megaprojects. The study seeks to identify the underlying causes of project underperformance and examine whether these factors differ from those commonly reported in developed-country contexts. By providing empirical evidence from South Africa, the study contributes to the broader megaproject management literature and offers practical insights for policymakers, government departments, state-owned entities, consultants, and contractors. Understanding the factors that drive cost overruns and delays is essential for developing effective mitigation strategies and improving the planning, delivery, and governance of future megaprojects.

2. Literature Review

2.1. Infrastructure Projects

Infrastructure development is widely recognised as a key driver of economic growth, productivity, employment creation, and improved quality of life (Ncube *et al.*, 2017). In South Africa, infrastructure investment has been identified as a strategic priority to address historical backlogs, improve service delivery, and stimulate economic growth. The South African government has committed significant resources to infrastructure development through initiatives such as the National Infrastructure Plan 2050 and the Strategic Integrated Projects (SIPs), which focus on transport, energy, water, sanitation, and social infrastructure.

South Africa's infrastructure investment programme comprises projects worth several trillion rand. According to Infrastructure South Africa (2023), more than R3 trillion in infrastructure projects have been identified for implementation over the next decade.

Large-scale projects such as the Medupi and Kusile Power Stations, the Gautrain Rapid Rail Link, the Ingula Pumped Storage Scheme, and major water transfer projects represent some of the country's most significant infrastructure investments. These projects were expected to improve energy security, transportation efficiency, water availability, and overall economic competitiveness.

Despite these investments, South Africa continues to face infrastructure delivery challenges. Several major projects have experienced substantial delays and cost overruns, raising concerns about planning effectiveness, governance systems, procurement processes, and project management capacity (Mabelo, 2020). These challenges have affected the ability of infrastructure projects to deliver their intended economic and social benefits.

2.2. Project delays and cost overruns

Cost overruns and schedule delays are among the most persistent challenges affecting infrastructure projects worldwide. Flyvbjerg (2014) argues that large infrastructure projects frequently exceed their budgets and planned completion dates because of optimism bias, strategic misrepresentation, inadequate planning, and weak governance structures. Cost overruns occur when actual project costs exceed the approved budget, while schedule delays arise when projects take longer than initially planned to complete.

Research has identified several causes of cost overruns and delays, including scope changes, inadequate front-end planning, design modifications, poor risk management, procurement inefficiencies, contractual disputes, inflation, and market volatility (Park, 2021; Gachie, 2019). In developing countries, additional factors such as corruption, political interference, skills shortages, and institutional weaknesses further exacerbate project performance challenges.

The South African construction industry has experienced many of these challenges. For example, the Medupi and Kusile Power Station projects recorded significant cost escalations and schedule delays. Originally budgeted at approximately R80 billion and R81 billion respectively, the projects experienced substantial increases in final costs and completion periods due to design changes, contractor performance issues, labour unrest, governance challenges, and technical failures (Mahlobo, 2022). Similar challenges have been reported in major transport and water infrastructure projects across the country.

The consequences of cost overruns and delays extend beyond financial losses. Delayed projects postpone the delivery of essential services, reduce expected economic benefits, increase financing costs, and can undermine public confidence in infrastructure investment programmes (Flyvbjerg, 2014).

2.3. Megaprojects in South Africa

Megaprojects are generally defined as infrastructure projects valued at approximately US\$1 billion or more that involve substantial complexity, long implementation periods, multiple stakeholders, and significant socio-economic impacts (Flyvbjerg, 2014). South Africa has undertaken numerous megaprojects across the energy, transportation, water, and industrial sectors. Notable examples include the Gautrain Rapid Rail Link, Medupi and Kusile Power Stations, the Ingula Pumped Storage Scheme, the Lesotho Highlands Water Project, and the Port of Durban expansion programme.

While these projects have contributed to infrastructure development and economic growth, many have experienced significant cost overruns and delays. The Gautrain project, initially estimated at approximately R25 billion, ultimately exceeded its original budget. Similarly, Medupi and Kusile became internationally recognised examples of megaproject underperformance due to escalating costs and delayed completion schedules (Mabelo, 2020).

Although international literature has extensively examined the causes of megaproject overruns, most studies have focused on projects in Europe, North America, and Asia. Limited empirical research has specifically investigated the factors contributing to cost overruns and schedule delays in South African megaprojects. Given the country's unique socio-economic, institutional, and governance context, there is a need to better understand the factors driving megaproject performance in South Africa. This study addresses this gap by examining the causes of cost overruns and schedule delays from the perspectives of industry experts involved in South African megaproject delivery.

2.4. Theoretical Underpinning

This study is underpinned by Agency Theory and Optimism Bias Theory. Agency Theory explains how conflicts of interest arise between principals (government clients and funders) and agents (contractors, consultants, and project managers), resulting in opportunistic behaviour, information asymmetry, corruption, and poor project outcomes. The theory is particularly relevant to megaprojects because their scale, complexity, and multiple stakeholder arrangements create opportunities for self-interested decision-making that may undermine project performance.

Optimism Bias Theory, advanced by Flyvbjerg (2014), explains the systematic tendency of planners and decision-makers to underestimate costs, completion times, and risks while overestimating project benefits. The theory provides a useful lens for understanding why megaprojects frequently experience cost overruns and schedule delays despite extensive planning efforts.

Together, these theories provide a framework for understanding how governance failures, strategic misrepresentation, and unrealistic planning assumptions contribute to cost overruns and delays in South African megaprojects.

3. Research Methodology

This study adopted a qualitative research approach to investigate the causes of cost overruns and schedule delays in South African megaprojects. A qualitative design was considered appropriate because it facilitates an in-depth exploration of complex issues and captures participants' experiences, perceptions, and interpretations regarding project delivery challenges (Creswell and Creswell, 2018). Given the exploratory nature of the study, semi-structured interviews were used as the primary data collection method.

For this study, megaprojects were defined as large-scale infrastructure projects valued at approximately US\$1 billion or more and characterised by significant complexity, multiple stakeholders, extended implementation periods, and substantial socio-economic impacts (Flyvbjerg, 2014). Relevant South African megaprojects were identified through government infrastructure reports, public investment programmes, and industry publications. These included major transport, energy, water, and public infrastructure projects that met the established criteria. A purposive sampling strategy was employed to select participants with direct involvement in the planning, design, procurement, management, or execution of megaprojects. Purposive sampling is appropriate in qualitative studies where participants are selected based on their ability to provide rich and relevant information on the phenomenon being investigated (Leedy and Ormrod, 2016). The sample comprised six experienced professionals, including project managers, engineers, quantity surveyors, construction managers, and infrastructure specialists who had worked on South African megaprojects.

Although the sample size was relatively small, qualitative research prioritises depth of insight rather than statistical representation. The selected participants possessed extensive knowledge and experience of megaproject delivery, enabling the collection of rich and detailed data. The sample size was considered sufficient because thematic saturation was achieved. Following the sixth interview, no substantially new themes emerged, and recurring patterns were consistently observed, indicating that additional interviews were unlikely to generate new insights (Guest *et al.*, 2006). Data were collected through semi-structured interviews guided by questions developed from the literature on megaproject performance, cost overruns, and schedule delays. The interviews focused on identifying the causes of delays and cost overruns and examining the role of project governance and

management practices in influencing project outcomes. All participants provided informed consent and granted permission for the interviews to be recorded. The recordings were subsequently transcribed verbatim for analysis.

Ethical clearance was obtained from the relevant university research ethics committee before data collection commenced. Participants were informed about the purpose of the study, confidentiality measures, voluntary participation, and their right to withdraw at any stage. All collected data were securely stored and used exclusively for research purposes.

The interview data were analysed using thematic analysis following the approach proposed by Braun and Clarke (2006). The process involved familiarisation with the data, coding, theme identification, theme review, theme definition, and reporting. Elements of qualitative content analysis were used during the coding stage to organise and categorise the data before broader themes were developed. Thus, content analysis served as a data reduction technique, while thematic analysis provided the overarching analytical framework. To enhance the trustworthiness of the findings, several measures were implemented. Participants were selected based on their expertise and direct involvement in megaproject delivery, interview data were transcribed verbatim, and an audit trail was maintained throughout the analysis process. Furthermore, findings were continuously compared across interviews to verify consistency and minimise researcher bias. These procedures enhanced the credibility, dependability, and overall trustworthiness of the study.

4. Findings and Discussion

This section shows the study results and discusses them to bring meaning. Data from this study were recorded and then transcribed. Thematic analysis was used to develop main themes and to code data. Thematic coding was used for the study. Table 1 below lists participants, their experience, and their positions.

Table 1: Profile of Respondents

Participants	Position	Years of experience
P1	Associate Professor/ Quantity Surveyor	25
P2	Quantity Surveyor	10
P3	Civil Engineer	35
P4	Quantity Surveyor	30
P5	Mechanical Engineer	20
P6	Quantity Surveyor	15

4.1. Corruption

The findings demonstrate that corruption remains a dominant factor affecting South African megaproject performance. While studies in developed countries often emphasise technical complexity and optimism bias (Flyvbjerg, 2014), participants in this study

identified corruption and governance failures as more significant challenges. This finding suggests that institutional weaknesses may play a more prominent role in developing-country contexts such as South Africa than in mature infrastructure markets. These findings support the arguments of Altshuler and Luberoff (2003), who contend that misinformation and hidden interests frequently influence infrastructure project decision-making. Participant responses further revealed that some professionals intentionally prolong projects to secure continued financial benefits, thereby increasing project duration and costs. This undermines investor confidence and discourages future investment in the South African construction industry. The findings therefore confirm the literature that ineffective governance, weak accountability, and misrepresentation of project realities significantly contribute to megaproject underperformance.

4.2. Poor Planning

Poor planning emerged as another significant factor contributing to delays and cost overruns. Participants highlighted inadequate front-end planning, insufficient stakeholder consultation, incomplete project scoping, and inadequate risk assessment during the conceptual and design stages. These findings align with Park (2021) and Gachie (2019), who identify poor planning, weak risk management, and inadequate project preparation as major drivers of project overruns. Participants emphasised that unclear project scopes, insufficient technical investigations, and failure to account for disruptions such as weather conditions, strikes, and community requirements often result in unrealistic budgets and schedules. The findings further support the view that effective planning and comprehensive stakeholder engagement are essential for improving megaproject performance.

4.3. Optimism bias

The study also identified optimism bias as a major contributor to project overruns and delays. Participants noted that project budgets, schedules, and expected outcomes are often unrealistically estimated due to excessive confidence among planners, contractors, and

decision-makers. These findings strongly support the work of Bent Flyvbjerg (2014), who argues that megaprojects are frequently characterised by underestimated costs and overestimated benefits. Political pressure and the desire to secure project approval were identified as factors that contribute to

unrealistic planning assumptions. Participants further highlighted that optimism bias leads to poor resource allocation and inadequate contingency planning. However, the successful implementation of the Gautrain was cited as evidence that realistic budgeting, proper planning, and effective governance can improve megaprojects.

4.4. Incomplete designs and contract documentation

Incomplete design and contract documentation were identified as additional causes of delays and cost overruns. Participants indicated that projects are sometimes approved before designs are fully developed, resulting in design changes, contractual disputes, and additional costs during implementation. These findings are consistent with the literature by Park (2021), which identifies contractual issues, scope changes, and poor project preparation as significant contributors to overruns. Participants also emphasised the importance of selecting appropriate contract strategies and allocating risks to parties best positioned to manage them. Weak documentation management and incomplete contractual information were found to increase the likelihood of disputes, delayed payments, and claims, ultimately affecting project delivery performance.

4.5. Inadequate Project Management Skills

The findings further revealed that inadequate project management skills and weak institutional capacity contribute significantly to project delays and cost overruns. Participants highlighted challenges relating to leadership, contractor management, stakeholder coordination, and the shortage of experienced professionals capable of managing complex megaprojects. These findings support the views of Mabelo (2020), who emphasises that successful infrastructure delivery depends on effective project management and coordination. Participants further noted that weak project oversight allows contractors to prioritise profit over project quality, cost, and schedule performance. Strong project management teams were therefore considered essential for ensuring accountability, maintaining quality standards, and

minimising delays and cost escalations in South African megaprojects.

5. Conclusion and Further Research

This study examined the causes of cost overruns and schedule delays in South African megaprojects. The findings identified corruption, inadequate front-end planning, optimism bias, incomplete design and contract documentation, and weak project management practices as the primary drivers of project overruns and delays. These challenges adversely affect project delivery and reduce the socio-economic benefits expected from megaproject investments.

The study contributes to the advancement of Agency Theory and Optimism Bias Theory by demonstrating how governance failures and unrealistic planning assumptions interact to influence project performance in developing-country contexts. It further provides empirical evidence from South Africa, a setting that remains underrepresented in megaproject research, which has predominantly focused on Europe, North America, and Asia. The findings offer practical insights for government departments, state-owned entities, consultants, and contractors on strengthening governance mechanisms, enhancing planning processes, combating corruption, and improving project management capacity.

Despite these contributions, the study is limited by its focus on South African megaprojects and its reliance on interview-based data, which may affect the generalisability of the findings. The study recommends strengthening anti-corruption measures, improving front-end planning, enhancing governance of design and contract documentation, and building project management capabilities to minimise cost overruns and schedule delays. Future research should develop and validate a conceptual framework that integrates these factors to improve megaproject performance and delivery outcomes

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