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# Factors Contributing to Cost Overruns of Construction Projects

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**ABSTRACT AND KEYWORDS**

**Purpose**

The primary objective of this study is to attempt to identify the major cost overrun factors in the construction sector of the Free State Province of South Africa, which can serve as the way forward for future projects in dealing with these cost overruns.

**Design/methodology/approach**

The study is based on a literature review investigating factors which have a significant influence on cost overruns and also a survey, consisting of a questionnaire and personal interviews, was conducted among professionals of the construction industry. The survey investigated factors that have significant influence in construction cost overruns of public sector projects. This includes misinterpretation of the client's brief, incomplete design at tender stage, procurement strategies and contractual claims such as contract instructions.The results were analysed and compared against the literature review.

**Findings**

Results indicated that indicated that the factors that has an influence in cost overruns of construction projects can be grouped into three categories i.e. very critical factors, moderately critical factors and less critical factors. It is important to

note that major attention still need to be given to all these factors collectively as they all contribute to cost overruns of construction projects

**Value**

This paper recommends that there is a significant need to identify factors that may influence construction cost overruns and to address these factors as early as the inception of the project. The results thereof will bring about a significant decrease in the occurrence of cost overruns and improve the cost performance on public sector projects.

**Keywords**

**Cost overrun, construction; public sector projects**

## 1. INTRODUCTION

In the past several decades, large construction projects have been known for their cost overruns and late completion times (Pickrell 1990; Flyvberg Holm & Buhl, 2003). Many factors are responsible for these cost overruns such as underestimation of costs to make the projects more viable, addition of scope during later stages of project planning and even during construction, changed conditions, etc. One of the most important contributing factors to the magnitude of cost overrun in large transportation projects are project delays. Furthermore, the length of project development phase from planning to construction seems to be a major factor in the extent of cost overrun (Flyvbjerg, Holm & Buhl, 2004). The longer, larger projects tend to be more prone to cost overruns (Touran and Lopez, 2006:1).

Maher and McGoey-Smith, (2006: 2) indicated that large transportation infrastructure projects are often significantly over budget. This phenomenon has been dubbed in the media as the “Big dig Syndrome” in reference to the Boston Central Artery system which was originally slated to cost $3 billion and is now heading towards $15 billion, as it reaches completion.

Not only is this syndrome solely a North America one; Europe’s Channel Tunnel and London Underground’s Jubilee Line were notoriously over budget. Budget overruns are common in other industries; almost all of Canada’s recent oil sands infrastructure projects have been reported as being significantly over budget. Note that these projects are owned and financed within the private domain.

Flyvbjerg and colleagues have studied the phenomenon of cost overruns on transportation mega projects systematically (Flyvbjerg, Holm & Buhl, 2002; Flyvbjerg et. al., 2004; Flyvbjerg, 2005). In a study of 258 transportation mega projects spanning 80 years and several countries, the authors report that:

- costs are underestimated in almost 90% of projects,


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- actual costs are on average 28% higher than estimated costs,
- cost overruns are independent of geographic location
- percentage overruns increase with the size of project and
- cost estimation has not improved over time Maher & McGoey-Smith, (2006: 3)

### 1.1 Which Projects get Build?

Flyvbjerg, (2005: 1) found it isn't necessarily the best ones, but those projects for which components best succeed in conjuring a fantasy world of underestimated costs, overestimated revenues, undervalued environmental impacts and overvalued regional development effects.
Flyvbjerg survey, the first and largest of its kind, looked at several hundred projects in more than 20 countries. Marchiavelli seems to have been Chief Adviser on these projects with his observation that "prices who have achieved great things have been those … who have known how to trick men with their cunning, and who, in the end, have overcome those abiding by honest principles". In fact there seemed to be a formula at work:
(underestimated costs)
+(overestimated revenues)
+(undervalued environmental impacts)
+(overvalued economic development effects)
=(project approval

Many project proponents don't hesitate to use this Machiavellian formular for project approval, even if it means misleading parliaments, the public and the media about the costs and benefits of projects. The result is an unhealthy "survival of the unfittest" for large public works and other construction projects Flyvbjerg, (2005:1).

### 1.2 Do Projects Grow Larger over Time?

Project size matters to cost escalation, as found above for bridges and tunnels. But even for projects where increased size correlates with neither bigger percentage cost escalations nor larger risks of escalation, as found for rail and road projects, it should be pointed out that there may be good practical reasons to pay more attention to – and use more resources to prevent – cost escalation in larger projects than in smaller ones.

For instance, a cost escalation of, say, 50% in a US$5 billion project would typically cause more problems in terms of budgetary, fiscal administrative and political dilemmas than would the same percentage escalation in a project costing, say, US$5 million. If project promoters and owners wish to avoid such problems, special attention must be paid to cost escalation for larger projects Flyvbjerg, Holm and Buhl, (2004: 10-11).


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### 1.3 Project Risk

Lee, (2008: 2) said that projects are inherently risky due to their long planning horizons and complex interfaces. The project scope or level of ambition will often change significantly during project development and implementation.

### 1.4 The Influence of Design on Cost

Kirkham (2007:4), considered the relationship between costs of buildings and procurement, where procurement is the method by which buildings are delivered to the client. Whereas Flanagan & Tate (1997:8) consider cost planning as a system that relates the design of a building to its cost, taking full account of quality, utility and appearance, the cost is planned to be within the economic limit of expenditure. Cost planning procedures are applied in an attempt to reduce the amount of recourses (and therefore cost) incurred during each stage of the development process, including design, construction, operation and maintenance, and subsequent replacement.

Kirkham (2007:3) referred back to biblical times in order to trace the origins of cost planning, and the reading they quoted from St Luke (Ch.14) gives a fascinating insight:

"Would anyone think of building a tower without first sitting down and calculating the cost, to see whether he/she could afford to finish it? Otherwise, once the foundations have been laid and he/she cannot complete it, all the onlookers will. "There is the man" they will say "who started to build and could not finish".

Whilst there are clearly metaphorical connotations within this reading, the point is pretty clear. To build well you must first plan. Interestingly, the final part of the reading is a harrowing reminder to many clients and builders in today's society who have not taken heed of good budgetary management (Kirkham, 2007:3).

The UK in particular has seen a rapid increase in construction output since the year 2000, but allied to this has been an increasing focus on project budgets, and moreover the ability to deliver these projects at the projected cost. Sadly, several high profile construction projects in the UK have been plagued with problems over programme and budget. With public sector construction projects there is a strong emphasis on meeting the budget, so when the project runs into financial difficulties, the taxpayer and media become rather unsympathetic. Some recent examples include the following (Kirkham, 2007:3):

### 1.5 Causes of overruns

Love (2011: 2) indicated that high profile infrastructure projects that experience cost and time problems or contractual disputes attract media attention as the community contribute to funding their delivery. Several notable projects in recent


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times include Denver's US$5 billion airport that experienced a cost overrun of 200%, the DKK 800 million Oresund bridge that experienced a 68% cost overrun (Flyvberg *et al*., 2003), and the Scottish Parliament Building which was over 3 years late and experienced more than a 900% cost overrun (Love, 2011). In Australia, several large scale social infrastructure projects (i.e., hospitals, law and order, museums, schools, recreational facilities), have experienced considerable delays due to poor project governance and design errors (Love, (2011: 2).
More contemporary examples of this phenomenon include the Western Australian Perth Arena that had an original contract value of A$168 million but is forecast to cost more than three times this amount, and be delivered at least three years later than expected.

South Africa, has also experienced some recent notable cost overruns in several large scale projects, examples are the soccer city stadium in Johannesburg built for R3,3 billion and experienced a cost overrun of 58% (Davie, 2010: online). Greenpoint stadium in Cape Town experienced a 50% cost overrun (Van Gass, 2007: online). Moses Mabhida stadium in Durban also experienced a cost overrun of 38% (Venter, 2009: online and Piliso, 2009: online).

Flyvberg *et al*. (2005) has suggested that average cost overruns for infrastructure projects can range between 20.4% for roads, 33.8% for bridges and tunnels and 44.7% for rail. In contrast, Love *et al*. (2010) report significantly lower levels of average cost overrun, with roads 13%, and bridges 5.5%. This observed differential can be explained by the monetary value of projects. Flyvberg *et al*."s (2005) research focused on mega-projects with contract values in excess of US$1 billion, whereas the contract value of Love *et al.*s' (2010) work was considerably smaller with an average contract value of A$33 million. Credence should therefore be given to Flyvberg *et al*.s (2004) assertion that a positive correlation exists between contract value and cost overrun.

According to Flyvberg *et al*. (2009) there are two rudimentary reasons why projects experience cost overruns. Firstly, strategic misrepresentation, which is an Orwellian euphemism for describing deceptive actions used by politicians and planners to ensure that projects proceed. Secondly, optimum bias, which encapsulates the systematic tendency for decision makers to be over-optimistic about the outcome of, planned actions. This includes over-estimating the likelihood of positive events and under-estimating risk and loss. The United Kingdom (UK) government has acknowledged that optimism bias is a problem in the planning and budgeting infrastructure projects and developed measures for dealing this with problem.

Love, (2011:12) many pathogen errors in engineering firms are based on practices (i.e. those pathogens from people's deliberate practices) that attempted to solve a particular problem. Further individuals may repeat inappropriate practices, such as taking short cuts and not following due processes. When a practice provides an individual with a satisfactory outcome then this practice is used again on future projects irrespective of its suitability.


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### 1.6 Causes of error

The relationship between strategic misrepresentation and optimum bias with cost overruns implicitly assumes causality in terms of counterfactual dependence of the effect on the cause: the cause is rendered counterfactually necessary for the effect (Love, 2011:13). For instance, to say that strategic misrepresentation caused a cost overrun is to say if the misrepresentation had not occurred, then the cost overrun would not have ensued. To be more precise, causality can be defined by reference to a causal chain of counterfactually dependent events, where a sequence of events (*C*,*E*,*F*..) is a chain of counterfactual dependence if *E* counterfactually depends on *C*, *E* counterfactually depends on *F* and so on. Basically, Love (2011) asserted that "one event is a cause of another if and only if there exists a causal chain leading from the first to the second" (Love, 2011:13).

Flyvbejerg, Holm and Buhl, (2002:282) conclude that the error of underestimating costs is significantly much more common and much larger than the error of overestimating costs. Furthermore Flyvbejerg et al (2002:285) ask the question of whether project promoters and forecasters have become more or less inclined, over time, to underestimate the costs of transportation infrastructure projects. If underestimation were unintentional and related to lack of experience or faulty methods in estimating and forecasting costs, then we would expect underestimation to decrease over time. Better methods have been developed and more experience gained through the planning and implementation of more relevant complex projects. It is therefore concluded that cost underestimation has not decreased over time. Underestimation today is in the same order of magnitude as it was 10, 30 and 70 years ago.

## 2. OBJECTIVE OF THE STUDY

The objective of the study was to identify the factors influencing cost overruns and rank them in order of significance to raise the level of awareness. The objective was achieved through a questionnaire survey. From the existing research finding, it was possible to identify the factors that influence cost overruns. These were organised in a questionnaire designed to enable respondents to add any other factor that they considered necessary for inclusion in the list of 21 factors. The questionnaire was supported by, informal interviews and discussions with some of the respondents.

## 3. RESEARCH: SURVEY ON FACTORS CAUSING COST OVERRUNS

The purpose of the survey was to establish the factors causing cost overruns and to evaluate the influence these factors have on cost overruns. The survey was sent to 25 professionals in the construction industry, comprising architects, engineers, quantity surveyors, project managers and contractors.


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These professionals comprised consultants in the private sector and professionals in public service, with some experience of the Free State situation. Responses to the questionnaire were received from twenty one (84%) of these professionals. The identification of the factors as well as evaluation of their impact is seen as important for future management of projects. This knowledge will enable project managers and project facilitators to concentrate on the most critical influences in respect of the control of costs on property development projects.

## 4. RESULTS AND FINDINGS

The first question was directed towards the establishment of whether construction cost overrun is seen as a problem in the Free State Province of South Africa. All the respondents considered cost overruns as a problem that needs to be addressed. Respondents did not consider all the factors listed to have a significant or equally important influence. According to respondents, the importance of factors on cost overruns may be divided into three categories i.e. very critical factors, moderately critical factors and less critical factors. However, all these factors should not be ignored in any given project.

Five factors were considered to be very critical, (valued at between 70% and 80%) contributing to cost overruns (Figure 2).

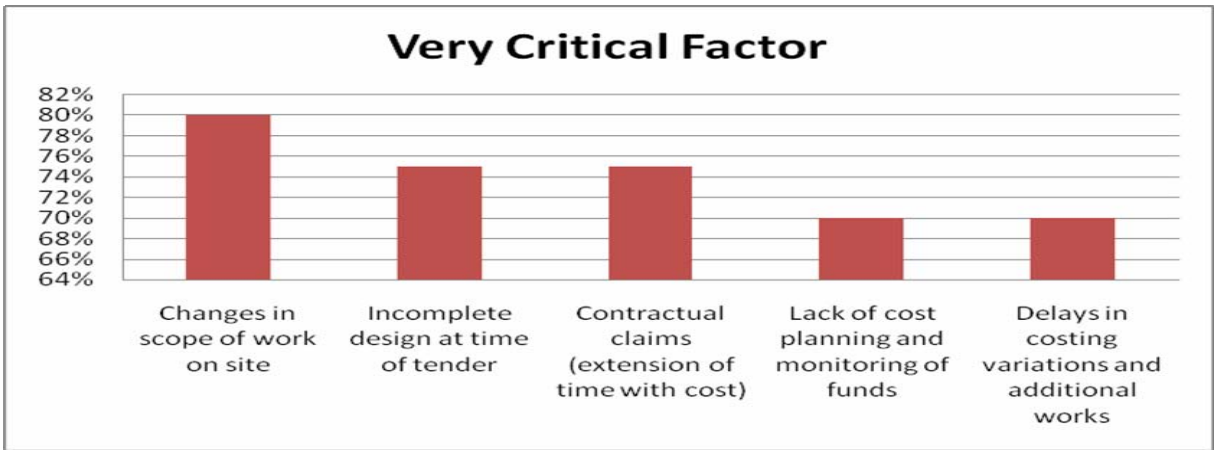


**Figure 2:** Five very Critical Factors of cost overruns

The five critical factors considered by the respondents and indicated by them as very critical, is shown in Figure 1 with importance of between 65% and 85%. Changes in scope of work on site by the client seemed to be the one with the most influence according to the respondents, but cannot be seen as controllable by the design team and is thus not seen as cost overrun related to budget items and must be equated for through an approval process driven by the client body.


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One of the perennial causes of claims for additional payment are defects in the design or documentation issued for a project at the outset. Just as design may change for technical reasons there will be instances where the client's requirements may change, often for unpredicted or unanticipated reasons (Davison, 2005:18).

Figure 2 clearly shows the important influence of design, claims, lack of cost planning and delays in costing of extras. The factor, "delays in costing of variations and additional works" is not seen itself as a factor causing cost overruns, but influences planning related to budgets because of the lack of timeous information.

Figure 3a & 3b shows the moderately critical factors of cost overruns as considered by the respondents. (50% to 64% importance)

Figure 3a shows factors directly influencing cost

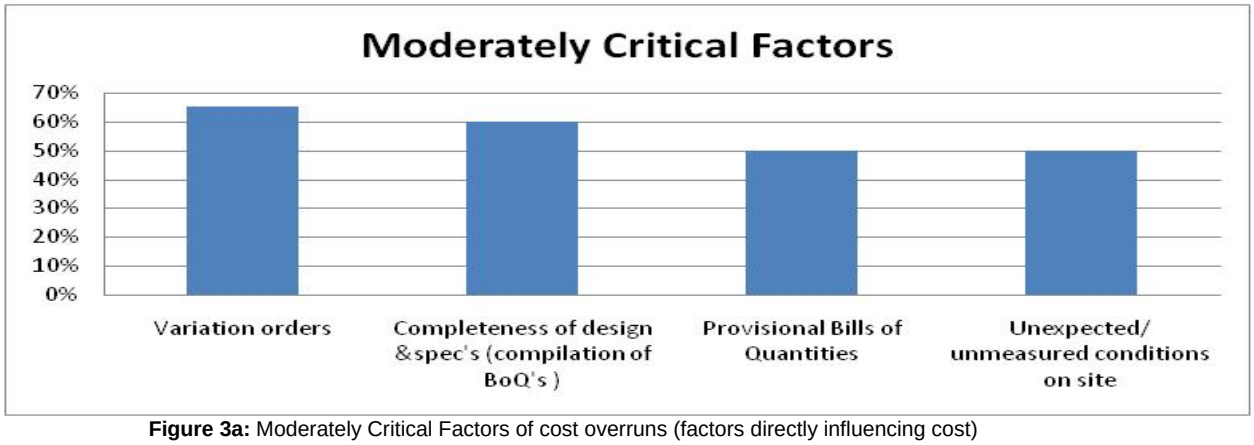


**Figure 3a:** Moderately Critical Factors of cost overruns (factors directly influencing cost)

**Figure 3b:** shows factors influencing cost information


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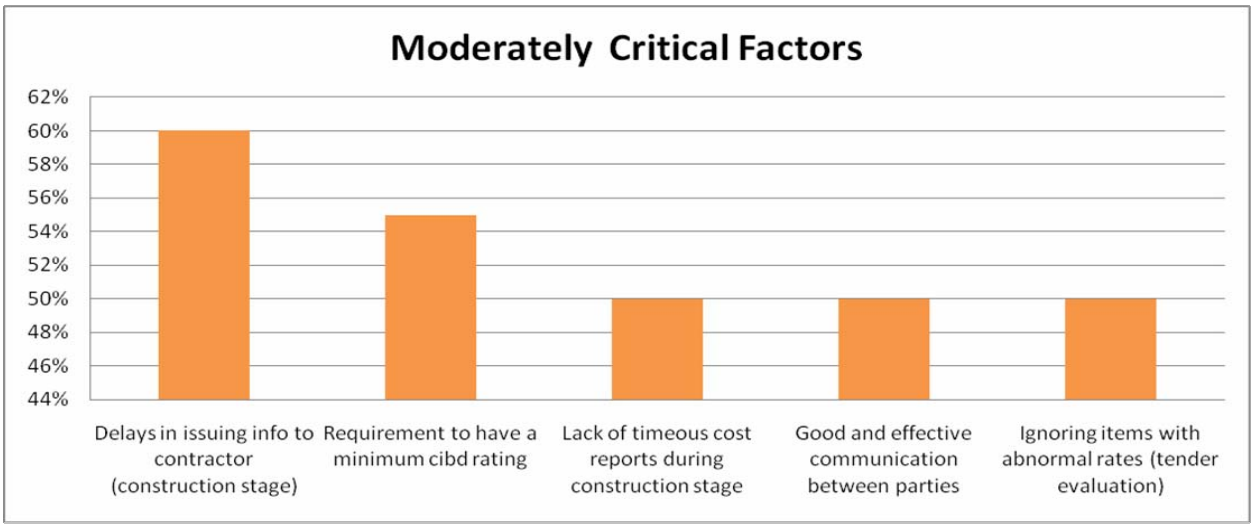


**Figure 3b:** Moderately Critical Factors of cost overruns (factors influencing cost information)

Classifying the various influencing factors under the above categories, narrows the problem and helps to deal with it more effectively. In these categories the responses were grouped between 50% and 64%, and were regarded as moderately critical with the variation orders scoring 65% in this category. It is not realistic however to believe that all the factors that influence cost overruns can be brought under control.

Figure 3 must be considered carefully because it may be divided into two categories; Figure 3a contains the factors that directly influence costs, and Figure 3b the factors that influence cost information.

In respect of factors influencing costs and therefore cost overruns the following factors are seen as fundamentally important:

- Variation orders: If variation is caused by change of scope or clients' changes then it becomes a budget change decision and cannot be seen as a cost overrun item in the "unexpected" category.
- Provisional Bills of Quantities: The effect of provision of quantities may cause cost overruns where to original quantities were under evaluated.
- Unexpected conditions caused by lack of prior investigation or natural influences.
- Completeness of design and specification is most important especially when Figure 1, results are considered.

Important factors influencing the availability of information are:

- Delays in issuing information to the contractor
- CIDB ratings
- Cost reporting
- Communication


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- Ignorance of abnormal rates: However if rates that are too high are ignored and items so priced are increased in number or volume cost overruns will occur.

**Figure 4:** shows the less critical factors of cost overruns.

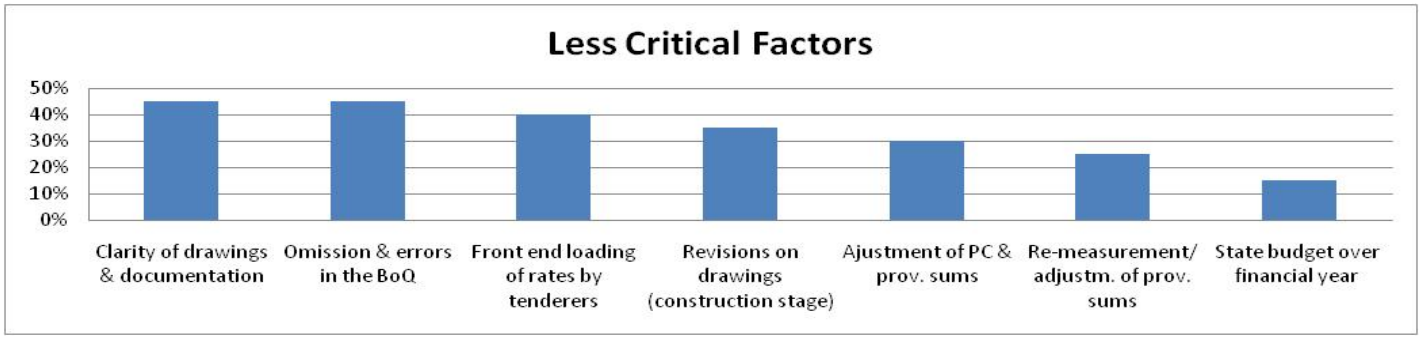


**Figure 4:** Less Critical Factors of cost overruns

In the less critical categories, the respondent's responses were grouped between 0% and 50%. These less critical factors indicated clarity of drawings and documentation as scoring 45%. On any given project, the factors under this category should be considered before dismissing them as insignificant. All these factors do contribute to cost overruns although the impact is minimal. It is however important to note that the adjustment to preliminaries and increases in respect of provisional sums due to under estimation may become critical if not planned and controlled well and are dependent on time and value rated pricing of the preliminaries bill.

## 5. CONCLUSION

It may be seen that most of the above factors, emanate from actions and omissions by both the client and the professional team. In this regard the first step towards minimising cost overruns may be to deal with the human factors first. The factors that were studied make it difficult to control cost overruns during the construction stage alone. Instead, there should be sufficient planning of the project at the inception stage. Drawings and other tender documents should be well detailed before going out to tender Chimwaso, (2000).

If imperfect techniques, inadequate data, and lack of experience were main explanations of the underestimations, we would expect an improvement in forecasting accuracy over time. Underestimating the costs of a given project leads to a falsely high benefit-cost ratio for that project, which in turn leads to two problems. First, the project may be started despite the fact that it is not economically viable. Or, secondly, it may be started instead of another project that would have yielded higher returns had the actual costs of both projects been


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known. Cost underestimation cannot be explained by error and seems to be best explained by strategic misrepresentation, i.e. lying, which is defined in the conventional fashion as making a statement intended to deceive others.

In conclusion, the factors that influence cost overruns have been identified and ranked in order of significance. These factors have further been classified into categories, to help deal with them effectively. The three categories are: very critical factors, moderately critical factors and less critical factors. However it is important to note that some factors cause cost overruns and others cause only the lack of information to enable parties to act upon timeously.

From the results of the questionnaire, it can be deduced that public sector projects in the Free State Province of South Africa, like in any other developing countries, are not free from cost overruns. It is still evident that:

- Cost overruns appears to be a global phenomenon
- Cost overrun appear to be more pronounced in developing nations
- Cost overrun has not decreased over the past 70 years. No learning seems to take place
- Cost underestimation and overrun cannot be explained by error and seem to be best explained by strategic misrepresentation, namely, lying with a view to getting projects started (Flyvberg, Holm and Buhl, 2004:3-4).

## 6. RECOMMENDATIONS

From the above findings the following recommendations are seen as applicable:

1. Client involvement is critical and client (employers) must recognise the importance of their influence on the effectiveness of cost planning and cost control. The design team cannot budget for items that are still in the clients' mind that are added to the project during the construction phase.
2. The budget must be updated when external influences like additions and variations are implemented by the employer and should not be seen by them then as cost overruns, unfortunately this perception is still present.
3. There is a need to identify the factors that may influence cost overruns and deal with them from the inception stage of each project. This will decrease the occurrence of cost overruns.
4. Since design changes may be a result of insufficient planning, a careful study should be done to determine the appropriate time scale in which to produce designs and other tender documents. This will help improve the quality of tender documents and lessen changes during the construction stage.

The implementation of a discipline involving a formal budget control, cost planning and cost control regime is seen as an important process to limit cost overruns of construction projects. Unfortunately formalisation of such a regime is


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currently not seen as an important priority in relation to a government project as it is not implemented well by design teams.

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