

**AN EVALUATION OF CONSTRUCTION PROJECT COST
MANAGEMENT FOR PUBLIC WORKS: A CASE FOR
BOTSWANA.**

By

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DECLARATION

I, **Harrison Njamu**, hereby declare that this treatise and all its contents are a result of my own effort and investigations. It is being submitted in partial fulfillment of the requirements for the Master of Science degree in Project Management in the Department of Construction Economics, Faculty of Engineering, Built Environment and Information Technology at the University of Pretoria. The treatise has not been submitted for any degree or examinations at this or any other University degree.

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DATE: November 2004

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ABSTRACT.

Title of treatise: An evaluation of construction project cost management for public works: A case for Botswana.

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The construction industry in Botswana faces a problem of cost variances on the construction projects. Hence, the identified problem needs to be attended to.

The study was an evaluation of how constructions cost on projects were managed. This entails establishing how project costs were planned, how projects costs were controlled and reported and finally how project costs at completion were analysed. This was done through questionnaires.

The major findings were that of inadequate planning for project costs. This could be attributed to the fact that, although the major cost planning factors such as

specifications and statement of work (Scope) were incorporated in the cost plan, they were not complete at the time the cost plan was determined. Consequently, they were the major causes of cost variances at post contract stage. Furthermore, cost control was not adequately conducted on projects.

Therefore, it is recommended that the government should provide a detailed brief and specifications to confirm the project requirements and also have standardised cost control measures on projects.

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LIST OF ABBREVIATIONS

ACWP	Actual Cost of Work Performed
BAC	Budget At Completion
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BIDP	Botswana Institute of Development Professions
CPI	Cost Performance Index
CV	Cost Variance
EAC	Estimate At Completion
EVM	Earned Value Management
EVMS	Earned Value Management System
JBCC	Joint Building Contracts Committee
P & Gs	Preliminary and General Costs
PMBOK®	Project Management Body of Knowledge
PPADB	Public Procurement and Asset Disposal Board.
QS	Quantity Surveyor
SOW	Statement of Work
SV	Schedule Variance
W B S	Work Breakdown Structure

CHAPTER ONE

THE PROBLEM AND ITS SETTING.

1.1 Introduction and general background.

Project Management is the planning, organising, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives (Kerzner, H. (2001:4).

One of the key resources in the above definition is cost as per the project management overview in the diagram below.



Figure 1. Overview of project management.

Source: Kerzner, H. (2001: 5)

A project is said to be successful if its completion is within the parameters in figure 1.

There are cost overruns on construction projects of which the client is not always well informed about. Since completing a project within its prescribed budget is one of the key parameters of project success, the interest was developed in establishing how the costs are managed.

Therefore, this study seeks to evaluate the cost management on public works construction projects in Botswana.

1.2 **Statement of the problem.**

The purpose of this research is to evaluate the effectiveness of the current cost management system for public works in Botswana and to determine the factors that can be improved upon.

1.3 **Statement of the sub-problems.**

Sub-problem one is to determine the extent to which cost planning factors are incorporated in cost planning techniques used in public works projects. *(To what extents are cost-planning factors incorporated in cost planning techniques used in public works projects?)*

Sub-problem two is to identify significant factors that influences construction cost overruns on public works projects. (*What significant factors influence construction cost overruns on projects?*)

Sub-problem three is to analyse the cost control measures that are used on public works projects. (*What cost control measures are used in public works projects?*)

Sub-problem four is to determine what constitutes completion of a project within the budget in an effective project cost management system. (*What factors constitutes completion of a project within the budget in an effective project cost management system?*)

1.4 Hypotheses.

Hypothesis one is that, cost planning techniques exist for public works but they are not effective due to inadequate description of the projects' scope of work, which is one of the major cost planning factor.

Hypothesis two is that the main causes of cost overruns are changes in the scope of work and project specifications.

Hypothesis three is that future project costs are not adequately analysed and reported, causing cost control measures to be ineffective.

Hypothesis four is that the project cost management system can be modified to suite specific projects that can lead to successful financial project control and completion.

1.5 Delimitations.

This research will be limited to the following:

1.5.1 Only Botswana Government projects in category “D” will be addressed as defined in section 1.6 below.

1.5.2 This study will not attempt to establish how exactly costs are derived at, but focuses on how costs are managed.

1.6 Definition of terms.

- **"Project cost management"** is a subset of project management that includes the processes required to ensure that the project is completed within the approved budget. It consists of resources planning, cost estimating, cost budgeting, and cost control. (PMBOK 2000:205).
- **"Botswana category D projects"** are construction projects with contractual values not exceeding eight million Botswana pula.
- **"Corrective action"** means changes made to bring expected future performance of the project in line with the plan.
- **"Estimate"** is an assessment of the likely quantitative result. In this context, it is applicable to project costs and durations.
- **"Earned Value Management"** is a method for integrating scope, schedule, and resources, and for measuring project performance. It compares the amount of work that was planned with what was actually earned with what was actually spent to determine if cost and schedule performance are as planned. (PMBOK 2000:201)

- **"Works"** means any work associated with the construction, reconstruction, and renovations of buildings.
- **"Effective"** means having a favourable effect or producing an intended result.
- **"Evaluation"** is a process that determines systematically and as objectively as possible the relevance, effectiveness, efficiency, sustainability and impact of activities on a project's performance, focusing on the analysis of the progress made towards the achievement of the stated objectives.
- **"Deliverable"** is any measurable, tangible, verifiable outcome, result, or item that must be produced to complete a project or part of a project.
- **"Milestone"** is a significant event in the project, usually completion of a major deliverable.
- **"Rework"** means action taken to bring a defective or nonconforming item into compliance with requirements or specifications.

1.7 Assumptions

1.7.1 **The first assumption** is that a structured approach to project cost management techniques is necessary for public works to ensure successful project management and completion.

1.7.2 **The second assumption** is that the project cost management system being used on category “D” projects is representative of what is possible on other government projects.

1.8 Research methodology.

The research method was a quantitative research. The sample size will be restricted to category “D” projects that have been completed in the last five years (2000-2004).

1.8.1 Literature review

The review of literature was mainly based on sources dealing with project cost management in other countries as well as Botswana, although enough local literature was not readily available.

The literature review assisted in the development of insight into project costs and how they can effectively be managed.

1.8.2 Sub-problem 1

To evaluate the first sub-problem, the following was undertaken:

a) Data source and sampling technique

Data was collected from Construction Industry Professionals namely Quantity Surveyors.

The national population of the number of firms registered, as consultant Quantity Surveyors with the Public Procurement and Asset Disposal Board of Botswana to handle category “D” projects was 30 in 2000. All this population was sought to participate in the research, hence there was no need for sampling.

b) Data collection

The researcher distributed 30 questionnaires to participants by hand. Out of the 30 questionnaires circulated to the sample population only 23 questionnaires were received back.

c) Data treatment

The participants were required to offer information related to public projects only and not on other private projects they may have handled. The data was restricted to projects completed during the last 5 years (2000-2004)

d) Data analysis

Descriptive statistical analysis by using the mode was used to analyse the data.

1.8.3 Sub-problems 2, 3 and 4

For these three sub-problems, the sources of data, treatment and analysis were in a manner similar to sub problem 1.

1.9 The importance of the study.

Cost overruns, arising from the time overruns, and other lapses on government projects are common. However, one of the hallmarks of a

successful project is no doubt, completion within the budget. Therefore, effective cost management is crucial on a project.

This study established the effective cost management for better planning, cost control and reporting to ensure successful financial completion of the construction project. It also highlighted the need for analysis of future costs so that corrective actions could be taken to ensure meeting the targets.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

Managing costs is one of the essentials of project management (Spinner, M.P.1997: 113). Further more, Turner, J.R et al (2000:293) emphasizes that successful management of project costs is a complex process that cannot be left solely to the Project Manager. It embraces many aspects of contractual management that also fall within the remit of other parties in the project organisation. Therefore, one of the factors that contribute to effective project cost management is cost awareness by all project participants throughout the life cycle of the project.

There is an analogy between managing time and managing costs. Time delays sometimes have a direct impact on costs in the sense that time delays may require additional funds. Hence, effective management of costs and time is the very essence of project management.

Effective cost management entails the following:

- Project costs must be planned.
- Project costs must be controlled and reported
- Project cost at completion must be analysed and predicted

2.2 PROJECT COST PLANNING.

2.2.1 Introduction.

The most critical phase of any project is the planning phase. This is also applicable to project cost management. Ideally, when the project is planned carefully, success is likely (Kerzner, H. 1998:89). Still, no matter how well one plans, changes are needed and the contingencies must be planned for or made available for the project. Therefore, an effective project cost management system must be flexible to accommodate changes that are inevitable on any project.

2.2.2 History and need for cost planning.

According to Kharbanda, O.P., Stallworthy, E.A. and Williams, L.F.(1987:3), project cost planning and cost control are identified to be as old as history. They refer to the Bible, which dates back more than 2000 years in history, mentioning the function of cost planning quite explicit as follows:

*“ For which of you, intending to build a tower, does not sit down first and count the cost, whether he has enough to finish it.”
(Luke14: 28, The Holy Bible, KJV).*

In the above bible quotation, it is evident that cost planning is essential for successful completion of the project. Not only cost planning, but also cost control is implied. This entails that, for the project to be successful in terms of being completed within the budget, the costs must be planned for.

2.2.3 Cost planning factors.

Cost planning is concerned with quantifying the cost factors to be applied to a project, assuming certain resources are available.

According to Kerzner, H. (2001:584), effective planning cannot be accomplished unless the necessary information becomes available at project initiation. The information requirements are:

- The statement of work (SOW)
- The project specifications
- The milestone schedules
- The work breakdown structure (WBS).

The above factors affect the project costs. Hence, effective project cost planning should incorporate these factors as discussed in the following sections.

a) The statement of work (SOW)

According to Cleland, D.I. and Ireland, L.R (2002:326), a statement of work describes the actual work that is going to be performed on the project which, when combined with the specification, usually forms the basis for the contractual agreement on the project.

This entails that the statement of work (sometimes called the scope of work) is a narrative description of the work required for the project. It describes what is to be done, achieved and delivered.

The SOW has cost implications to the project. If misinterpreted, it can result in cost overruns and ultimately cause cost management to be ineffective. It is, therefore, important that it is in writing to clarify and confirm the requirements and serve as a reference document throughout the further life cycle of the project. It is against this document that final approval and acceptance of the “deliverables” will be measured at the conclusion of the project or contract (Basson, G. 2003).

Furthermore, the PMBOK © (2000:57) states that,

“When there is poor scope definition (SOW), final project costs can be expected to be higher because of the inevitable changes which disrupt

project rhythm, cause rework, increase project time, and lower the productivity and morale of the workforce.” [(SOW) inserted]

For effective project cost planning, the SOW must be clearly stated due to its cost implications.

In the construction industry, the SOW is called a “brief”. It, usually, is not as formal as it should be despite its importance. The finally agreed SOW is the contractual statement of work. It constitutes the finally offered and accepted requirements. The alterations to it should be agreed in writing.

b) The project specifications

Specifications are the descriptions of the technical content of the project. These specifications typically describe the product of the project and the requirements the product must meet. (Cleland, D.I. and Ireland, L.R 2002:327).

They are precise definitions of the quality of the products required or processes to be followed to achieve the prescribed results.

Specifications are, in fact, standards for pricing out a proposal hence they affect the cost of the project. They are one of the cost planning factors that

has significant cost implications on the project and are to be accurate and clear.

The reasons for accuracy and clarity are that, small deviations in specifications or interpretation can have vast financial implications. It is also often the grounds for dispute in the construction industry.

c) The milestone schedules.

The PMBOK (2000:203) defines a milestone as,

“A significant event in the project, usually completion of a major deliverable.”

Therefore, a milestone project schedule is a summary of planned dates for activities that identifies the major milestones.

According to Kerzner, H. (2001:572), project milestone schedules contain such information as:

- Project start date
- Project end date
- Other major milestones
- Data items (deliverables or reports)

A milestone schedule establishes the time parameters of the project and helps managers to effectively coordinate and manage costs. It becomes an effective part of the project cost control system during the life span of the project.

The milestone schedules' formats are seldom elaborate programmes. It, usually, consists of a list of dates or a linear time scale with black triangles to denote dates for deliverables.

d) The work breakdown structure (WBS).

The work breakdown structure is a deliverable-oriented grouping of project elements that organises and defines the total scope of the project (PMBOK 2000:209). It is a means of dividing a project into the easily managed elements that ensure the completeness and continuity of all the work that is required for successful completion of the project.

In terms of project cost planning, the process of developing the WBS is to establish a scheme of dividing the project into major cost groups and minor ones. It is structured in a way such that project costs will be summarised and eventually reported.

The importance of the WBS is that, it provides a common framework from which:

- Cost planning can be performed.
- Costs and budgets can be established.
- Time, cost and performance can be tracked.
- Schedules and status-reporting procedures can be established.
- Network construction and control planning can be initiated.

Kerzner, H. (2001:574) concludes regarding the WBS that, it acts as a vehicle for breaking the work down into smaller elements, thus providing a greater probability that every major and minor activity will be accounted for.

In summary, the effective cost management should link the project cost plan to the work breakdown structure.

2.2.4 Project cost estimating.

a) Introduction.

In planning for the costs of a project, cost estimating is a cardinal aspect of the plan. Cost estimating involves developing an approximation (estimate) of the costs of the resources needed to complete activities

(PMBOK 2000:86). Consequently, an accurate estimate of project costs is an essential part of the proper basis for management decisions and control if project objectives have to be met.

The importance of efficient cost estimating is vital both to the client and to the contractor. Reasonably accurate estimates are essential to the initial decision on whether to proceed with the project or not, that is, the “go/no-go” decision (Harrison, H.L. 1990:80). The costs that should be planned for are explained in the following section.

b) Types of costs.

The following are the different costs to be included in project cost estimating as emphasised by Burke, R. (1993:195),

- **Direct costs:** These are cost, which can be specifically identified within the activity or project. These costs include direct material costs, labour costs, direct equipment costs and direct expenses. The distinctive nature of direct costs is that total expenses can be charged to the activity.

- **Indirect Costs:** These are costs which cannot be directly booked to an activity or project, together with costs that may be incurred

whether the project is executed or not. Indirect costs are also called overheads.

- **Preliminary and general costs (P&Gs)** are also part of the indirect costs that are not recovered elsewhere in the estimate.

c) Cost estimating.

According to Kharbanda, O.P. and Jeffrey, K.P. (1996),

“Project estimating is indeed the yardstick for project cost control. And if the yardstick is faulty, you start on the ‘wrong foot’. It is in this context that we exhort you not to underestimate the estimate.”

In cost estimating, the estimator considers the causes of variation of the final estimate for purposes of better managing the project. It entails, the process of forecasting the cost of completing project deliverable.

Estimating project cost either has macro or micro approaches.

- The macro approach is used in situations where information needed to derive accurate cost estimates is not available, especially in the initial phase of the project. The main disadvantage of macro approaches to estimating is that the cost

of a specific task is not considered. The estimates by this approach are referred to as top-down estimates.

- The micro approach is where the estimating process is pushed to work package level for bottom-up estimates. This process can take place after the project has been defined in detail.

d) Cost estimate pitfalls.

When planning for the costs, pitfalls may occur which may lead to inaccurate estimates. Kerzner, H. (2001:771) identifies some of the pitfalls that include the following:

- Misinterpretation of the statement of work
- Omissions or improperly defined scope
- Poorly defined or over optimistic schedule
- Inaccurate work breakdown structures
- Applying improper skill levels to tasks
- Failure to use the correct estimating technique
- Failure to understand or account for cost escalation and inflation

These pitfalls are linked to the factors, which affect cost planning. For effective cost estimates, these pitfalls should be avoided although many of

these pitfalls do not become evident until detected by the cost control system, well into the project.

2.2.5 Project cost plan.

The project cost plan (budget) displays the cost estimate for each control package. It is the final result of the cost planning process.

Once the cost plan is approved, it needs to be 'time-phased'. Hence, a project cost plan represents the time-phased expenditure plan which is the aggregate of all project costs, both direct and indirect.

In summary, the approved cost plan becomes the project cost baseline. This cost baseline is a time-phased budget that will be used to measure and monitor cost performance on the project (PMBOK 2000:90).

2.2.6 Conclusion.

The importance of project cost planning should not be underestimated for it acts as a foundation to be built upon. When planning for the costs, all the cost planning factors should be properly quantified to derive a reliable project cost plan. The cost plan is the basis for monitoring of costs as well as control.

2.3 PROJECT COST CONTROL.

2.3.1 Introduction.

Having planned the costs for the project, the next step is to control those costs during the execution stage.

One of the key elements of project success is completion within the budget which makes project cost control essential. Kharbanda, O.P and Stallworthy, E.A. (1986:20) state that:

“ Effective project cost control is, in our judgment, the key to successful project management and hence an essential element in every project success. Yet, despite its importance, it is still a very neglected subject, preached far more often than it is practiced.”

This statement emphasises the need for cost control.

According to Lokyer, K. and Godon, J. (1996, P.67), the following are the six essential features that a control system appears to have (in this case the “cost plan”):

A plan must be made

- This plan must be published
- Once working, the activities being controlled must be measured.
- The measurements must then be compared with the plan.
- Any deviations must be reported to the appropriate person.
- A forecast of the results of any deviations must be made, and corrective actions taken.

These features must be incorporated in the project cost control system for it to be effective.

2.3.2 Cost control defined.

The PMBOK (2000:199) defines control generally as,

“ The process of comparing actual performance with planned performance, analysing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.”

As per the above definition, control is the monitoring of performance, that is, what has been done, what is being done and what is yet to be done against the plan.

In terms of project cost control, it is not only “monitoring” of costs and recording perhaps massive quantities of data, but also the analysing of data in order to take corrective action before it is too late (Kerzner, H. 2001:813). Cost control entails control of the future instead of just mere bookkeeping of performance. Cost control also provides corrective actions to ensure project success.

In summary, project cost control is the controlling of changes that affect the project budget or the cost plan, hence, the need for project cost evaluation. With regard to project evaluation, Cleland, D. and Ireland, L.R (2002:400) recommend that it should be performed either on a routine basis or for specific reasons.

2.3.3 Project change control

The change control functions ensures that all changes to the scope of work are captured and approved by the designated people before they are incorporated in the baseline plan (Burke, R. 1993:92). This is due to the fact that one of the major causes of time and cost overruns is scope change.

For effective change control that affects cost control, a project should have a formal change control process or procedure. The change control

process should adhere to the “KISS” principle (“Keep It Simple, Stupid”) so that it is not burdensome to the project.

It should be noted that change control is management, not paperwork as emphasized by Fringeti, E and Comninos, D. (2002:229). Therefore change control is about:

- Analysing the situation reflected in the reports
- Deciding what course of action is necessary to recover the plan.
- Proceeding with the recovery actions.

2.3.4 Earned value analysis.

a) Introduction.

Project cost control is concerned with ensuring that projects stay within the cost baseline (budget), while getting the work done on time and within the correct degree of quality. The earned value system (variance analysis) is one of the frequently used methods to measure these factors. The project manager is allowed to determine “trouble spots” in the project and to take corrective action by the variance analysis. Therefore, to measure performance for cost control purposes, the Earned Value Management System can be utilised as a cost management technique.

b) Earned value structure or plan.

The key to mastering earned value is to understand the terms used. The following are the names and abbreviations used in earned value analysis as depicted in figure 2.

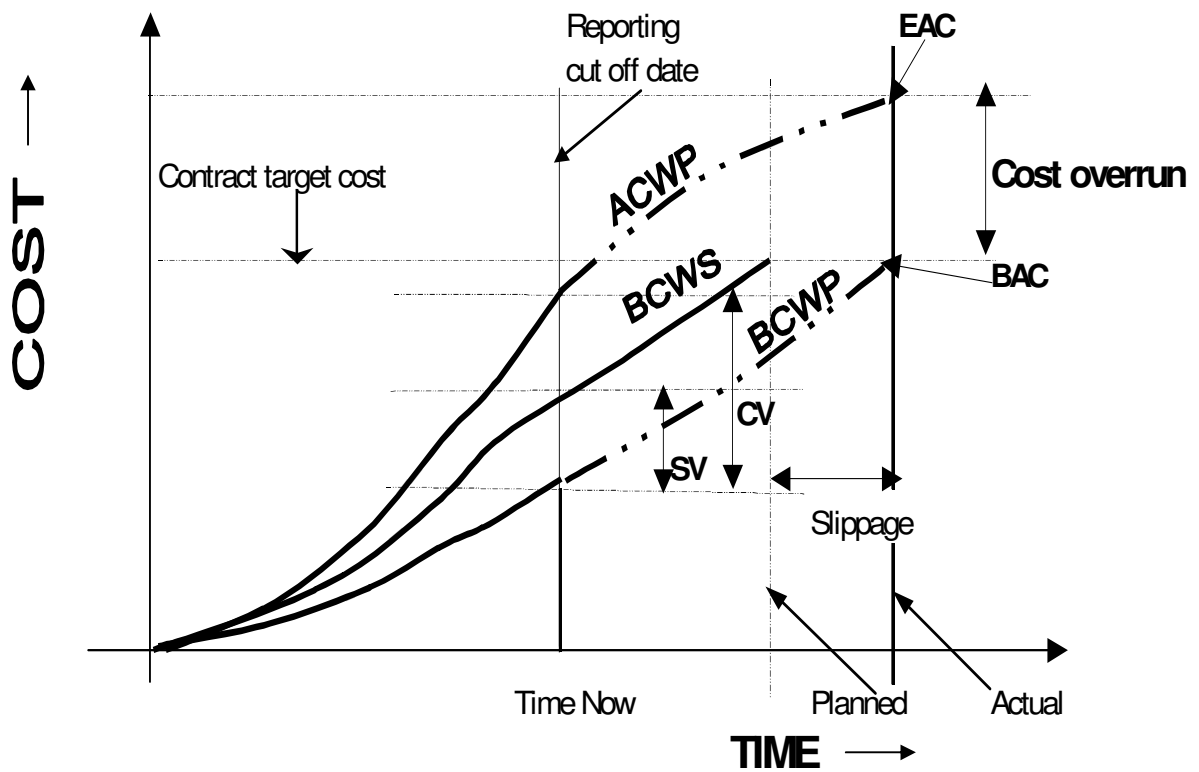


Figure 2. Graphical status reporting (Earned value curves).

Source: Adapted from Kerzner, H. (2001:856) and Basson, G.

- **Budgeted Cost of Work Scheduled (BCWS).** This is the budget or cost estimate of work scheduled to be completed at the measurement date. It corresponds with the time-scale budget.

- **Budgeted Cost of Work Performed (BCWP).** This is the budget for the completed work or amount of money that the amount of work actually performed at the measured date, should cost to be in line with the budget or cost estimate. It is the sum of the approved cost estimates for activities completed during a given period. This is called the “earned value”, as it is a measure of work done at budgeted cost. It is also the amount which will be paid to an outside contractor if work was done by a party external to the organisation (Basson, G.)

- **Actual Cost of Work Performed (ACWP).** These are total costs actually incurred (direct and indirect costs) in accomplishing work during a given time period.

- **Budget At Completion (BAC).** This is the original cost estimate, budget or quotation indicating the funds required to complete the work.

- **Estimate At Completion (EAC).** This is the revised budget of the project based on the current productivity. It is the expected cost of the project when the defined scope of work is completed.

- **Cost Variance (CV).** This is the measure of the deviation between the earned value (BCWP) or and the actual cost of doing the work (ACWP). See figure 2.

- **Schedule Variance (SV).** It is any difference between the scheduled completion of an activity and the actual completion of that activity. Its calculation is a measure of time deviation between the planned progress (BCWS) and earned value (BCWP), expressed in monetary value or time units (TU).

Having discussed the earned value nomenclature and definitions, the following sections attend to the earned value forecasts and variances as a control and monitoring technique.

c) Earned Value forecast or project performance monitoring.

Forecasting the final cost of the project is vital information required by the client and senior management. This information is also vital for the project cash flow.

The Earned Value Management System (EVMS) does not control project costs and schedule overruns, but should signal the trend in sufficient time to permit some action by decision makers (Cleland, D. and Ireland, L.R. 2002:423). Therefore, it is a useful tool for monitoring the costs on a project.

According to Fringenti, E. and Comninos, D.(2002), monitoring the actual progress and cost individually against the schedule and budget does not ensure performance is proceeding according to plan. The project may be ahead of schedule but running over the budget, resulting in an overall below-par performance. It is therefore necessary to monitor performance by integrating time and cost monitoring.

The variables, BCWS, BCWP and ACWP as defined earlier, can be used to calculate variances that provide more insight into the status of the project. The variances can be calculated as follows:

$$\text{Schedule Variance (SV)} = \text{BCWP} - \text{BCWS}$$

$$\text{Cost Variance (CV)} = \text{BCWP} - \text{ACWP}$$

d) Example of Progress Tracking Using Spending Curves.

Consider the curves shown in Figure 3 as adapted from Lewis, J.P. (1997:89). On a given date, the project is supposed to have cost 50 000

(50k) (BCWS). The actual cost of work performed (ACWP) is 60k. Finally, the Budgeted Cost of Work Performed (BCWP) is 40k. Under these conditions, the project would be behind schedule ($SV=BCWP-BCWS=40k-50k=-10k$) and over spent ($CV=BCWP-ACWP=40k-60k=-20k$) that should signify that there is a problem on the project. This entails that decisions have to be made to redress the situation.

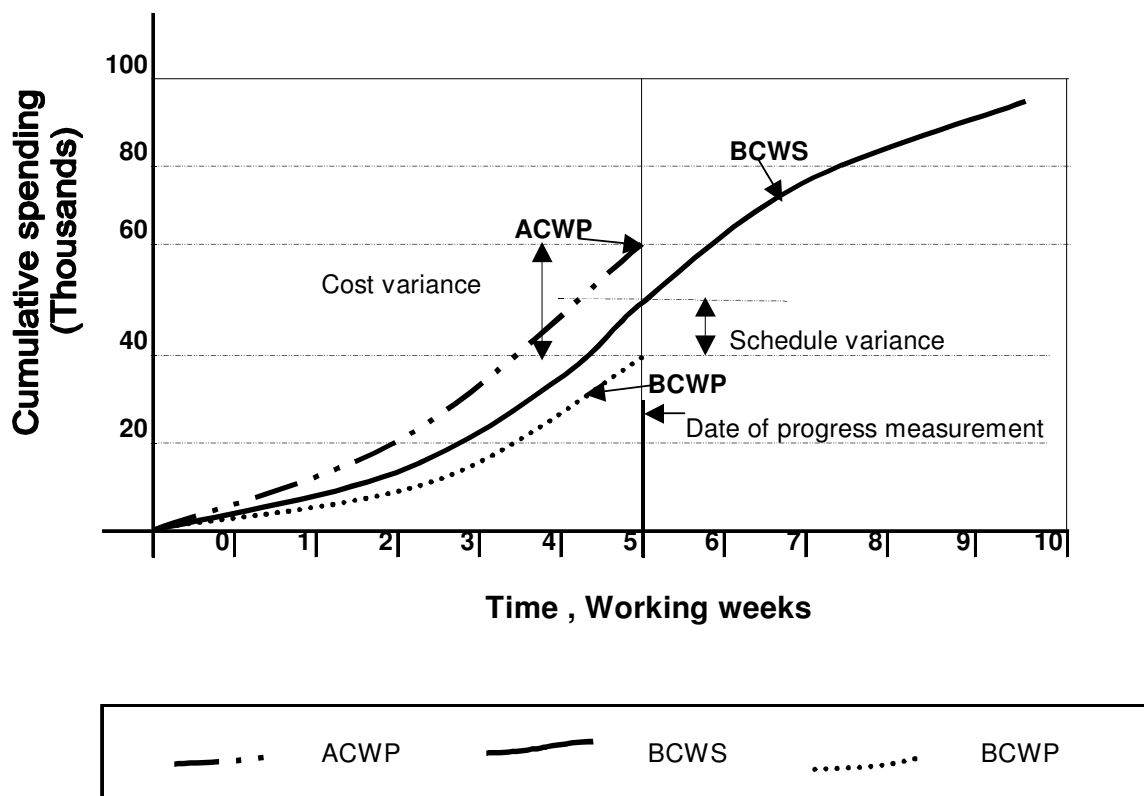


Figure 3: Earned value analysis, behind schedule and over spent.

Source: Lewis, J.P. (1997: 89)

e) Cost reporting.

The reporting process has the superficially simple objective of providing suitably summarized and formatted information to all levels of management (Berry, A. et al 1993: 18). If a project is to be successfully completed, all relevant project participants must be kept informed about the status of the project.

It should be noted that there are no set or rigid prescribed standards for communicating project status. However, various schedules, graphs and reports can be used. Enough information must be reported to indicate status and allow decision making, without causing an 'information overload' (Fringenti, E. and Comminos, D. 2002:227).

i) Status reporting (variance analysis).

Reporting procedures for variance analysis should be as brief as possible. The reason for this, according to Kerzner, H. (2001:853), is that the shorter and more concise the report, the faster the feedback can be generated and responses developed.

A typical example of a relatively simple status report in tabular format is shown in table 1.

VARIANCE ANALYSIS (cost in thousands)						
Subtask	milestone status	BCWS	BCWP	Actual Cost	Variance, %	
					Schedule	Cost
1	completed	100	100	100	0	0
2	completed	50	50	55	0	-10
3	completed	50	50	40	0	20
4	not started	70	0	0	-100	-
5	completed	90	90	140	0	-55.5
6	not started	40	0	0	-100	-
7	started	50	50	25	0	50
8	completed	0	0	0	-	-
Total		450	340	360	-24.4	-5.9

Table 1. Tabular format of a simple project status report.

Source: Kerzner, H. (2001: P 854)

NOTE: In the cost report summary, it can be reported that the costs are running approximately 5,9%(refer to table 1.) over budget (cost plan) and the reason given such as increased cost of labour and materials.

ii) Estimate At Completion (EAC).

In cost reporting, it is important to show the estimated overall cost at completion of the project. This is a forecast of total project costs based on performance. According to Fringenti, E. and Comminos, D. (2002:223),

there are fundamentally two methods for forecasting the estimated cost at completion.

- The **first** method entails re-estimating the cost of the remaining work in the manner originally used to estimate the total project cost. This estimated cost is then added to the actual costs to date to arrive at Estimate At Completion (EAC).
- The **second** method involves the use of performance indices to calculate the forecasts statistically. The following simplified formula can be used to estimate the cost of completion.

$$EAC = \frac{ACWP}{BCWP} \times BAC$$

where; BAC = Budget At Completion

With reference to table 1, if the original cost estimate which is the budget at Completion (BAC) is say 579 000, then

$$EAC = \frac{ACWP}{BCWP} \times BAC$$

BCWP

$$= \frac{360}{340} \times 579\,000 = 613,059$$

340

In the above calculations, the expected project cost overrun is 34 059 which is the Estimate at Completion (EAC) less the Budget at Completion (BAC), [i.e. 613 059-597 000 = 34, 059]

f) Conclusion.

Earned value analysis is cardinal to effective project cost management. It reviews the “trouble spots” in terms of costs necessitating the appropriate action to redress the situation.

2.3.5 Cost report summary.

Project cost summaries and predictions are commonly presented in tabular form. Table 2, as shown on next page, is a typical example of widely used arrangement for cost report preparation. It is a tabular presentation of project cost data, including forecast costs to completion and predict final variances.

Project Cost Report Summary										
Project Title						Page of				
Project Number						Report date				
A Item	B cost date	C original budget	D Authorised budget changes C+D	E authorised current bugdet	F ACWP	G BCWP (assessed)	H CPI	J forecast costs remaining (E-G)/H	K forecast costs at completion F+J	L forecast variance at completion E-K

Table 2. A project cost report in tabular form

Source: Lock, D, (2000:581)

2.3.6 Conclusion.

Project cost control play a major role in effective project cost management. It is meant not only for monitoring of costs but to analyse data, forecast of the results of any deviation from the cost plan and take corrective action before it is too late. Cost control emphasizes the need to control future cost before they occur to ensure project success.

2.4 FINANCIAL PROJECT CLOSURE AT COMPLETION.

2.4.1 Introduction.

Each Project comes to an end, eventually (Gray, C. and Larson, F. 2002:366). The project closure may be due to many factors, but in this study it entails completion of the works as per contract.

Project management activities do not necessarily end with the physical completion of the construction project. A number of loose and important ends need to be tied up (Lockyer, K. et al 1996:585). This includes the financial aspects.

Project financial closeout include:

- Finalizing all the claims and agree upon them.
- Final cost reports are compiled and reported complete with cost variances, analysis and comments.

Contracts are concluded by the issue of the final payment certificate and/or certificate of final completion or acceptance (Basson, G.)

The financial project closure should be done other wise the project management proverb which states that,

“Projects progress quickly until they become 90% complete; then they remain 90% complete forever.” (Kerzner, H. 2001:289) may be proved right.

2.4.2 Contractual basis for financial closeout.

It is a contractual stipulation in contracts that the final account of the monies due to the contractor or employer should be prepared and the payments made thereof. If this is not done, it is a breach of contract and it has many legal consequences.

The period in which the final account should be prepared is usually stated in the contract. Therefore effective project cost management should adhere to the relevant clauses in the contract, for example, clause 34.1 in the JBCC principal agreement declare that,

“ The Principal Agent shall prepare a final account for submission to the contractor within ninety (90) working days after the date of practical completion.”

Hence, financial closeout of a project is a contractual obligation to be complied with.

2.4.3 The closeout process.

Once the project comes to an end, the closure must be planned and scheduled, monitored and controlled-as if it is a project in its own right. This administrative closure work is carried out in addition to the activities already planned to complete the production of project deliverables. (Fringenti, E. and Comminos, D. 2002:238). It is also emphasised that both of these plans need to be monitored and controlled to ensure timely and effective completion of the project.

2.4.4 Control of late changes.

Control of late changes of minds adds significant extra work just as the contractor is tidying up to prepare for handover to the client. These extras are usually not budgeted for and can add considerable costs to the project and seriously affect the schedule. According to Young, T.L. (1996:185), any significant changes at this stage are best treated as a follow-on project after closing the current project.

2.4.5 Closeout analysis and documentation.

The financial aspects of the project should be concluded as per the contractual requirement. At this stage, all the claims not previously finalized are addressed, evaluated and agreed.

2.4.6 Final reports.

The final cost reports should be compiled and submitted, together with cost variances, analysis and comments. This is one of the last administrative tasks that must be performed before terminating the project due to completion of the works. It should be done within the contractual stipulations.

2.4.7 Post mortem

When the project is finished and the final costs known, an investigation can be conducted to compare the actual expenditure with the original estimate (Lock, D. 2000:485). Such post mortem examinations are obviously too late to be of benefit to the completed project, but they can be helpful in pointing out mistakes to be avoided when estimating or conducting future projects.

2.4.8 Conclusion.

Project financial closure at completion is just as important as other phases in the life of a construction project. Therefore, it should be planned and executed to its completion. It is an administrative task that should be done as per contract or earlier to ensure success of project cost management.

2.5 SUMMARY

The literature review chapter looked at how effective cost management can be implemented on a project. The following aspects were discussed which focuses on the management of costs.

- Project cost planning, which is emphasized as one of the crucial elements if the project has to be successful. It is true that when the project is planned carefully, success is more likely.
- Cost control is identified as a means for controlling future cost and making corrective decision to ensure project success.
- Lastly the financial closure of a project at completion is just as important as other aspects of cost management.

CHAPTER THREE

RESEARCH FINDINGS.

3.1 Introduction

This Chapter contains data of the research findings. The data was gathered from construction professionals namely the Quantity Surveyors (QS) who are registered with the Public Procurement and Asset Disposal Board (PPADB) in Botswana to handle construction projects in category “D”. The data gathered was for projects completed during the last five years.

The objective of the research was to gather data for the purpose of evaluating the effectiveness of the current project cost management for public works in Botswana and determine the factors that can be improved upon.

3.2 Sample size.

The population sample of construction professionals (Quantity Surveyors) for this research was based on those registered with PPADB to carry out government projects and is located in the capital city, Gaborone. It was noticed that all the registered population of

Quantity Surveyors have offices in the capital city. The research was confined to Gaborone only due to logistic considerations.

Since the population was only 30, there was no sampling and the questionnaires were hand delivered to all the firms for responses.

3.3 Composition of the questionnaires.

The purpose of the questionnaire was to gather relevant data and test the hypotheses based on the responses by the sample population of the construction professionals.

The questionnaire comprised of two sections.

- Section One addressed issues concerned with the pre-contract phase of the construction project as sub-problem one. All the four questions sought to establish how cost planning on construction projects was done and determine the factors that were considered when planning for the costs.

- Section Two of the questionnaire had 15 questions that addressed issues in line with the post contract phase of the construction project as sub-problem 2,3 and 4

The majority of the questions were to be answered by ticking or marking (X) in the appropriate box on a scale of 1 to 5. The chosen answer was an indicator of the respondent's perception.

3.4 Research response.

Out of the 30 questionnaires circulated to the selected population, 23 questionnaires were received back. This represents a 76.7% response. All the 23 questionnaires were physically collected. Apart from the responses from the questionnaires, almost half of the respondents were informally interviewed for the purpose of gathering further views and clarifications on certain questions in the questionnaire and other issues, which were not expressly covered in the questionnaire.

The following were the responses indicating the research findings.

3.5 Pre-contract phase findings.

At pre-contract phase, the questionnaire was designed establish what factors were considered when determining the project cost plan (budget). Further more, a professional opinion was sought regarding the completeness of the brief given to consulting professional

(Architect) by the employer or client regarding what was required to be achieved on a construction project.

Question one and response to it was as follows,

Question 1: *Which of the following factors were included when determining the cost plan (Budget) of the Project?
Indicate by hierarchy of importance.*

Planning factor	1 Never	2 Hardly	3 Sometimes	4 Often	5 Always
Statement of work (brief)	1	3	3	9	7
Project specifications	1	0	4	8	10
Milestone Schedules	3	7	9	3	1
Work breakdown Structures	3	5	7	4	4

Table 3. Questionnaire responses on cost planning factors

Note: The bold letter in the table indicates the mode as follows:

<u>Planning factor</u>	<u>Scale rating</u>
• Statement of work (brief)	4 (often)
• Project specifications	5 (always)
• Milestone Schedules	3 (sometimes)
• Work breakdown Structures	3 (sometimes)

The graphical representation of table 3 results in terms of mode is shown in figure 4 below.

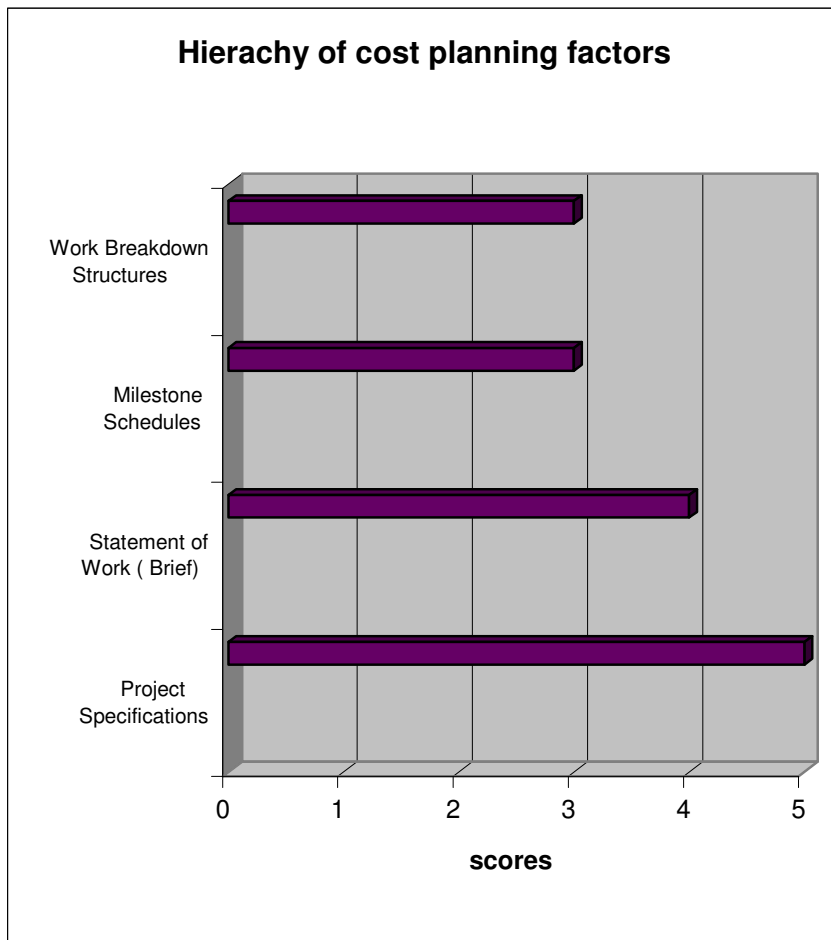


Figure 4. Hierarchy of importance of cost planning factors

From the above responses, it shows that all the factors were included at planning stage when determining the cost plan (budget) of the project. The hierarchy of importance established is as follows;

1. Project specifications
2. Statement of work (brief)
3. Milestone schedules
4. Work breakdown Structures

Other factors according to respondents (questionnaires and verbal) include the following:

- Design of the project
- Contract format
- Location of the project
- Sketch designs

The second question was intended to find out the completeness of the brief by the employer to the Architect and from the Architect to the QS. The question and responses are indicated on next page.

Graphically, the results in table 4 are shown below in figure 5.

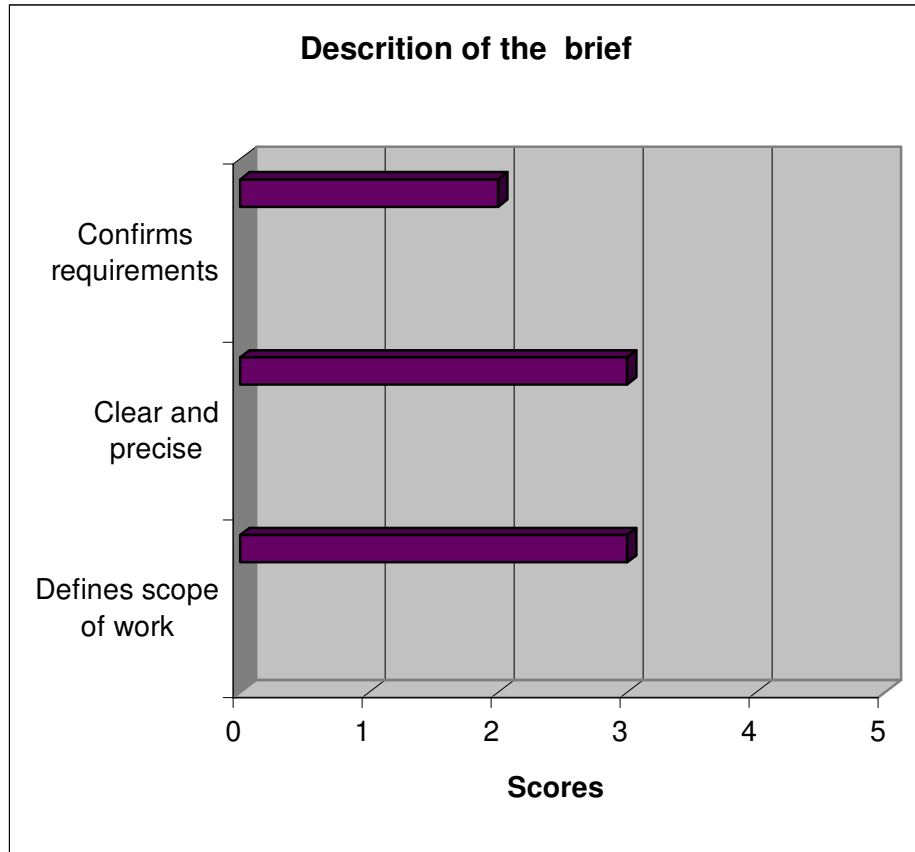


Figure 5. Graphical representation of research brief description.

According to the above results, the majority of the respondents were of the opinion that the brief was inadequate and can be described in terms of the percentages as:

- Clear and precise: about 60%
- Confirms project requirements: about 40%
- Properly defines the scope if work: about 60%

In terms of completeness of the project specifications at cost planning stage, the question and results are as follows.

Question 3: *Were the Project Specifications complete at the time when the project cost plan (budget) was determined?*

Brief description	Scores	Percentage
Always	0	0%
Often	5	22%
Sometimes	6	26%
Hardly	8	35%
Never	4	17%
Total	23	100%

Table 5. Response on the completeness of specifications

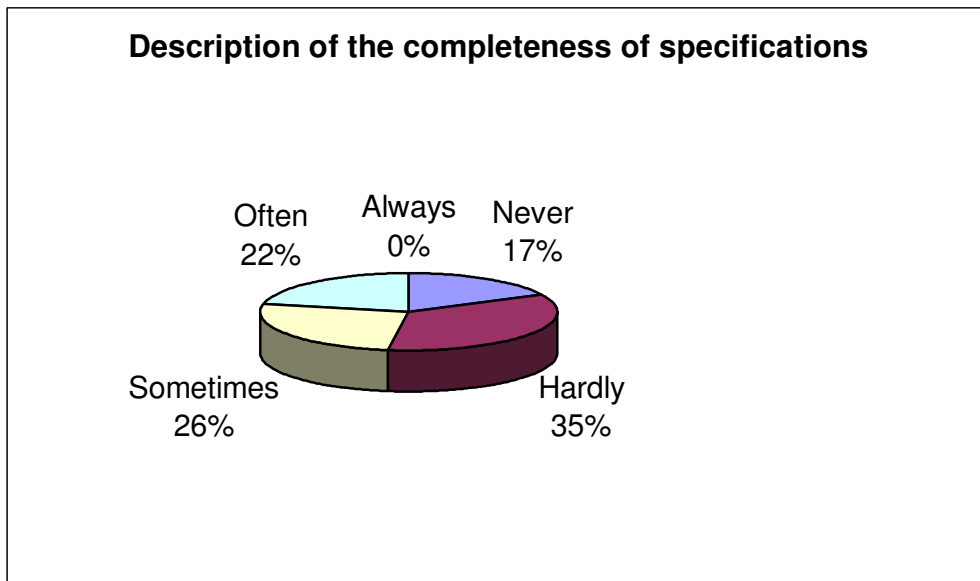


Figure 6. Description of the completeness of specifications

The above graph of the research findings shows that the project specifications were hardly complete at the time the cost plan was established.

The fourth question was to confirm the requirements of question 1 and the results are shown in table 6.

Question 4: Indicate below, how the project cost plan (budget) was linked to the following factors.

Planning factor	1	2	3	4	5
	Never	Hardly	Sometimes	Often	Always
Statement of work (brief)	1	3	6	8	5
Project specifications	0	3	3	10	7
Milestone Schedules	3	8	9	2	1
Work breakdown Structures	4	4	10	3	2

Table 6. Responses to link of budget to cost planning factors

Note: The bold letter in the table indicates the mode as follows:

<u>Planning factor</u>	<u>Scale rating</u>
• Statement of work (brief)	4 (often)
• Project specifications	4 (often)
• Milestone Schedules	3 (sometimes)
• Work breakdown Structures	3 (sometimes)

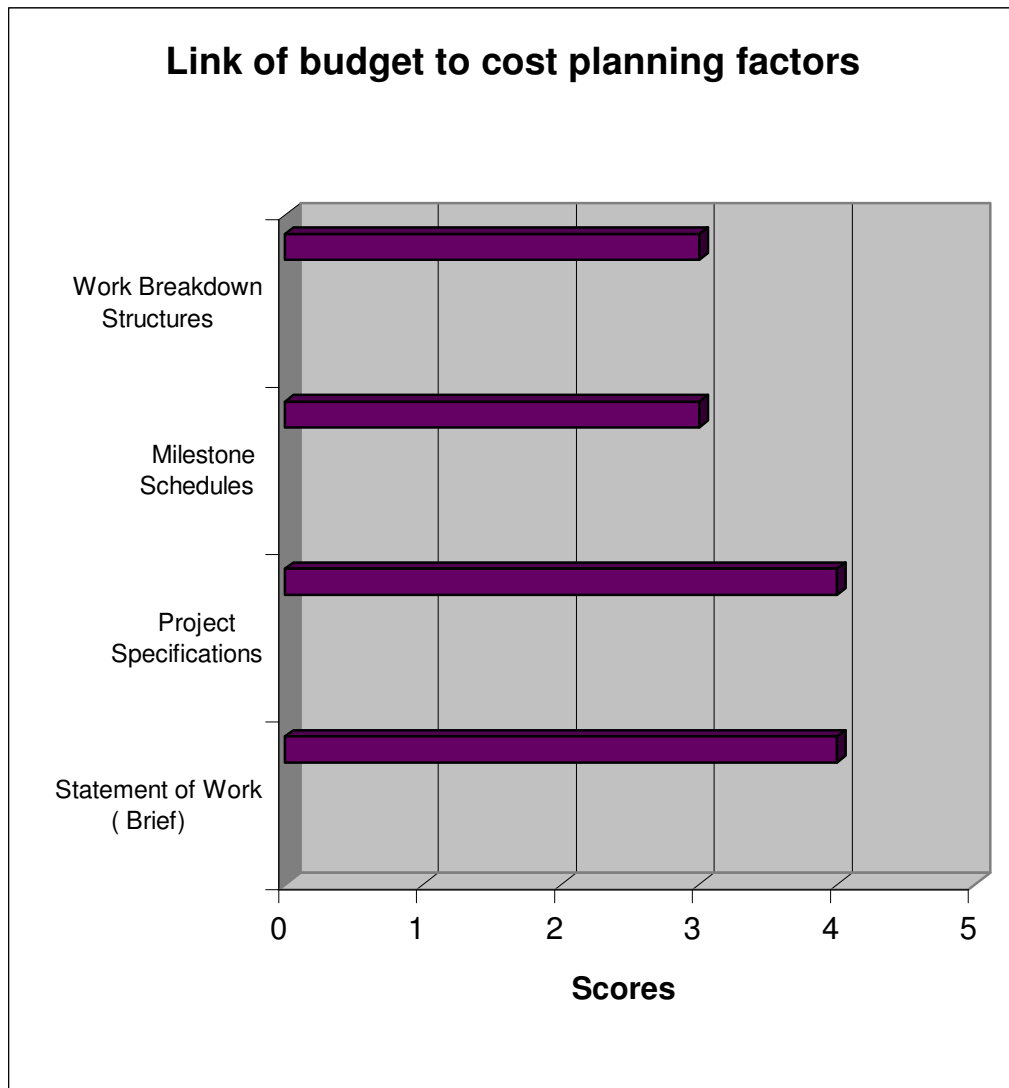


Figure 7. Link of cost plan (budget) to cost planning factors.

Note: Refer to chapter 4 for the discussion and comparison of the results of questions 1 and 4.

3.6 Post contract phase findings.

The main objective with regard to the post contract phase was to identify significant factors that cause cost variances and how cost control was implemented on projects. Project cost reporting was also to be revealed.

In order to achieve the above objectives, the questionnaire was designed to gather data in with these objectives. The following were the responses from the questionnaire (question 5 to 19).

Question 5 stated that, *“During project execution, were costs incurred as planned?”* The responses are indicated below.

Response	Score	Percentage
YES	2	8.7%
NO	21	91.3%
Total	23	100%

Table 7. Responses to incurrence of cost as planned

The majority of the respondents (91.3%) indicated that costs during execution stage of the project were not incurred as planned. This indicates that there were cost variances.

The response to question six is indicated below.

Description	Response
• Was the employer (or representative) aware of the cost variances?	4 (often)
• Was the employer (or representative) approve the cost variances?	5(always)

Table 8. Responses to awareness and approval of cost variances

The above responses, the respondents indicated that the employer was often aware of the cost variances on projects and always approved the cost variances.

Question seven was intended to reveal the stage at which the cost variances were made known to the employer. The responses are indicated in table 9.

Question 7: *When was the employer made aware, in most cases, of the cost implications of changes made on a project?*

Cost variance awareness stage	1 Never	2 Hardly	3 Sometimes	4 Often	5 Always
Before changes were executed	2	1	5	7	7
While changes were executed	1	8	7	4	3
After changes were executed	5	5	4	7	1
At final account stage	6	4	4	8	0

Table 9. Responses on employers' awareness of cost variances

According to the above responses, the employer was informed of the cost implications of variations at different stages on ad hoc basis. The analysis of the effectiveness of cost management and cost implications to the employer is discussed in the next chapter.

Question eight was intended to establish the major causes of the cost variances. The question and responses are indicated below.

Question 8: *What were the major causes of the cost variances?*

Causes of cost variances	1 Never	2 Hardly	3 Sometimes	4 Often	5 Always
Changes in scope of work	0	1	4	7	11
Changes in specifications	0	2	3	10	8
Omission of costs in budget	3	10	3	3	4
Extension of time claim	1	3	5	8	6
Others	2	1	1	1	0

Table 10. Responses on major causes of cost variances

Note: The bold letter in the table indicates the mode as follows:

<u>Causes of cost variances</u>	<u>Scale rating</u>
• Changes in scope of work	5 (always)
• Changes in specifications	4 (often)
• Omission of costs in budget	2 (hardly)
• Extension of time claims	4 (often)
• Others	1 (never)

Graphical representation of above data using the mode is indicated in figure 8

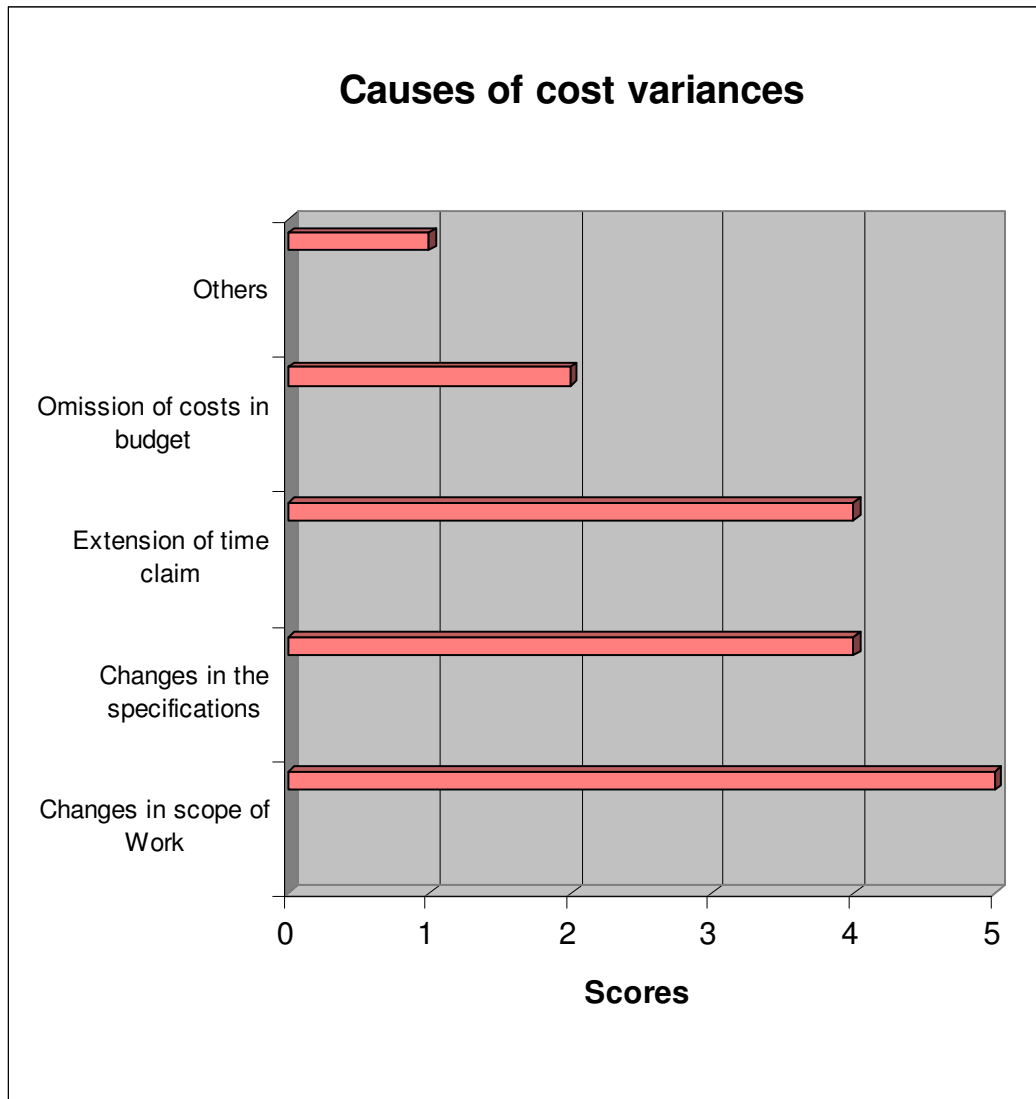


Figure 8. Ranking of major causes of cost variances

According to the above results, the majority of the respondents were of the opinion that the major causes of cost variances on construction projects are in the following order,

1. Change in the statement of work (Scope)
2. Change in the specifications
3. Extension of time claims
4. Omission of costs in budget

Other reasons that were specified are

- Price fluctuations
- Unforeseeable ground soil conditions

Cost reporting findings.

In terms of cost reporting, the majority of the respondents indicated that there was cost reporting on each project. They further indicated that the cost report was standardized. The responses are indicated below.

Question 9: *During the execution phase of the project, was there any cost reporting to the client indicating the project status?*

Response	Score	Percentage
YES	23	100%
NO	0	0%
Total	23	100%

Table 11. Responses on project status cost reporting

Question 10: *If yes, was the cost report format standardised?*

Response	Score	Percentage
YES	19	82.6%
NO	4	17.4%
Total	23	100%

Table 12. Responses on standardisation of cost report format

From the informal interviews with the respondents, it was clarified that firms had their own standard format of the cost report. So the standard format referred to here is only applicable to each firm and not other firms and the variations could be expected on the report formats depending on a firm handling a particular project.

The frequency of the cost reports was every 3 months as indicated by 95% of the respondents.

The responses on the main contents of the report are indicated in table 13 (question 12 responses).

Cost report contents	YES Scores	NO Scores	YES Percentage	NO Percentage
Title and date of the report	23	0	100%	0%
Original budget (contract sum)	23	0	100%	0%
Authorised budget changes	22	1	95.6%	4.4%
Estimates of instructions issued	22	1	95.6%	4.4%
Allowances for anticipated changes	23	0	100%	0%
Graphs, variances per project (Earned value)	6	17	26%	74%
Others	5	18	22%	78%

Table 13. Responses on major contents of the cost report

Question thirteen was intended to establish who among the consultants was responsible for the cost report despite having many participants to it. The response is indicated below.

Question13. *Who was responsible for the cost reporting?*

Consultant	Responses
Architect/Principal Agent	1
Quantity Surveyor	22
Others	0

Table 14. Responses on who was responsible for cost reporting

This indicates a 95.6% response in favour of the Quantity Surveyor as the consultant responsible for the project cost reporting.

Question 14 was to establish the participants and their level of involvement in project cost control as indicated below.

Question 14: *Who participated/or was involved in project cost control? Please tick the level of involvement as below.*

Level of involvement (scores)

Cost control participants	0%	25%	50%	75%	100%
Architect/Principal Agent	1	4	6	12	0
Quantity Surveyor	0	0	0	7	16
Mechanical Engineer	1	10	5	5	2
Electrical Engineer	1	9	6	5	2
Civil Engineer	3	11	6	3	0
Contractor	7	9	4	2	1

Table 15. Responses on cost control participants

Note: The bold letter in the table indicates the mode as follows:

<u>Cost control participants</u>	<u>Involvement rating</u>
• Architect/Principal Agent	75%
• Quantity Surveyor	100%
• Mechanical Engineer	25%
• Electrical Engineer	25%
• Civil Engineer	25%
• Contractor	25%

The response is graphically shown in figure 9.

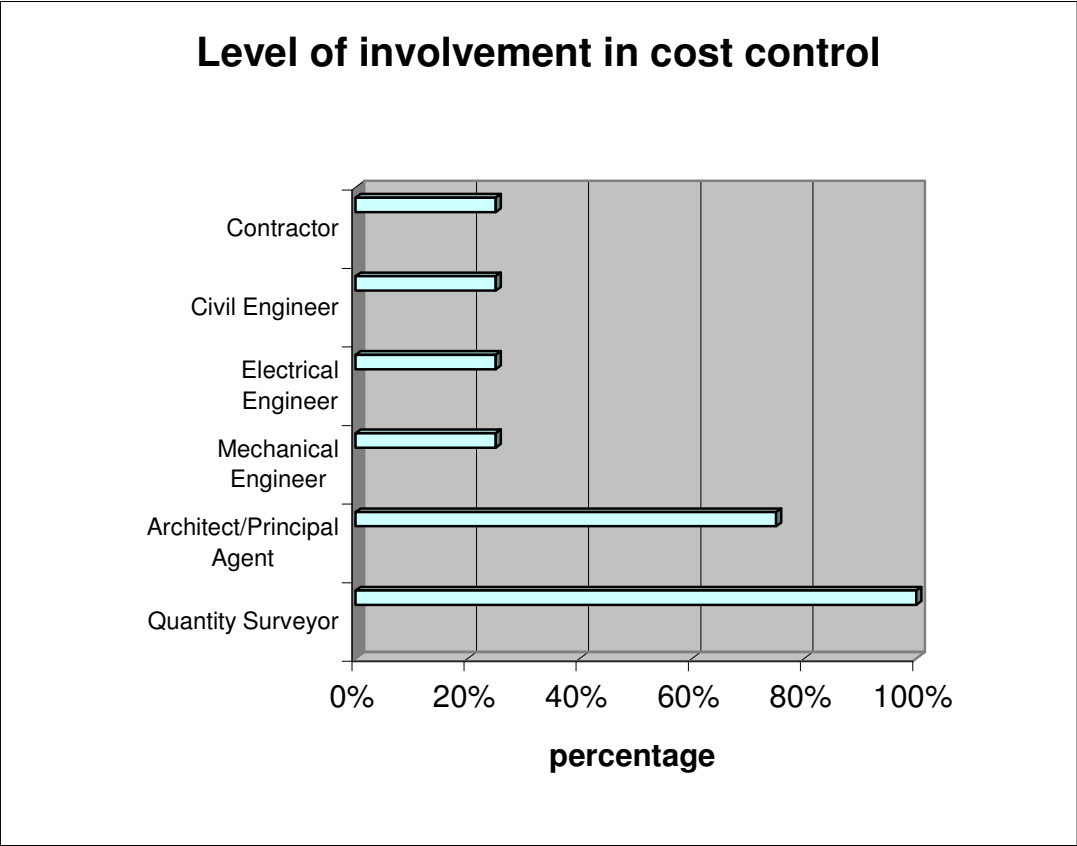


Figure 9. Level of involvement in project cost control.

Apart from their involvement in cost control, generally, about 75% were also involved in cost reporting as indicated on next page.

Level of involvement (scores)

Cost reporting	0%	25%	50%	75%	100%
Cost control participants (as indicated in question14)	1	2	7	8	5

Table 16. Responses on cost reporting involvement

The bold letter in the table indicates the mode, which entails that 75% of the respondents, indicated that the cost control participants were also involved in cost reporting.

Question 16 and 17 were included to establish the stage at which the contractual claims were settled and agreed by the parties involved, namely the contractor and the employer's representative consulting professional. The results are as follows:

Question 16: When were contractual claims settled?

Settlement of contractual claims	1 Never	2 Hardly	3 Sometimes	4 Often	5 Always
Soon after occurrence	1	7	4	5	6
After completion of the project.	2	4	5	8	4

Table 17. Responses for when contractual claims were settled

Note: The bold letter in the table indicates the mode as follows:

- Soon after occurrence 2 (hardly) ($2/6 \times 100 = 33\%$)
- After completion of the project 4 (often) ($4/6 \times 100 = 67\%$)

Regarding the settlement of contractual claims, the respondents indicated that 33% of the contractual claims were settled soon after occurrence and 67% of the claims were settled after completion of the project.

The results are graphically indicated in the pie chart below (figure 10)

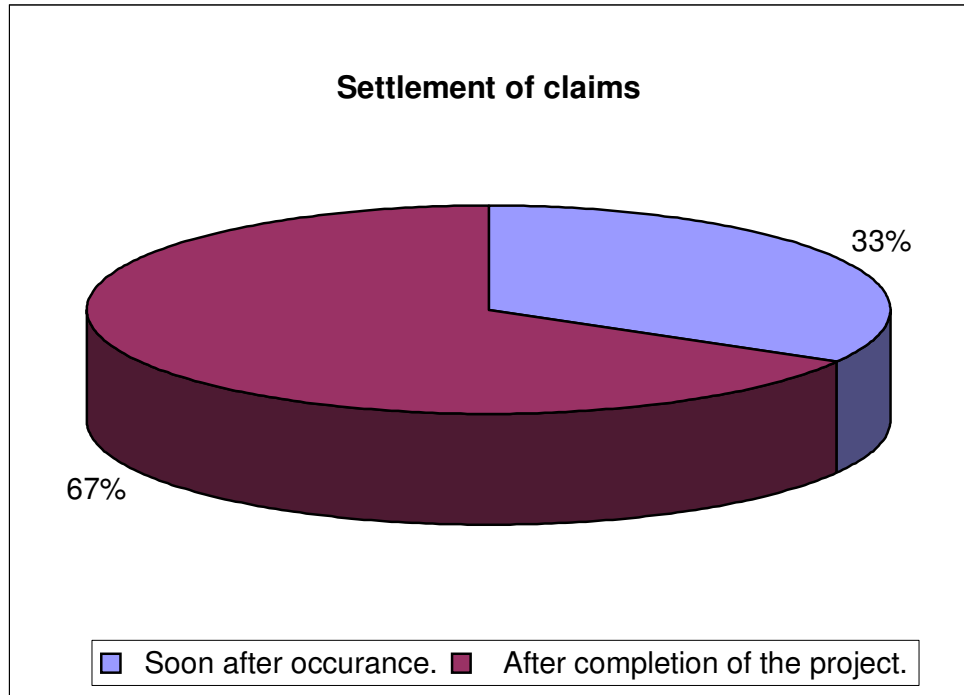


Figure 10. Graphical indications on when the contractual claims were settled

Question 17: *When were the final account claims concluded and agreed?*

Table 18 indicates the results as follows:

Conclusions of final accounts	1 Never	2 Hardly	3 Sometimes	4 Often	5 Always
Within a month after practical completion	16	4	0	2	2
Within 3 months after practical completion	7	8	4	4	0
Within 6 months after practical completion	3	5	8	4	4
After 6 months after practical completion	1	3	2	9	8

Table 18. Responses on when final accounts were concluded.

Note: The bold letter in the table indicates the mode as follows:

<u>Cost control participants</u>	<u>rating</u>
• Within a month after practical completion	1(never)
• Within 3 month after practical completion	2(hardly)
• Within 6 month after practical completion	3(sometimes)
• After 6 month after practical completion	4(often)

The responses are indicated in the following graph.

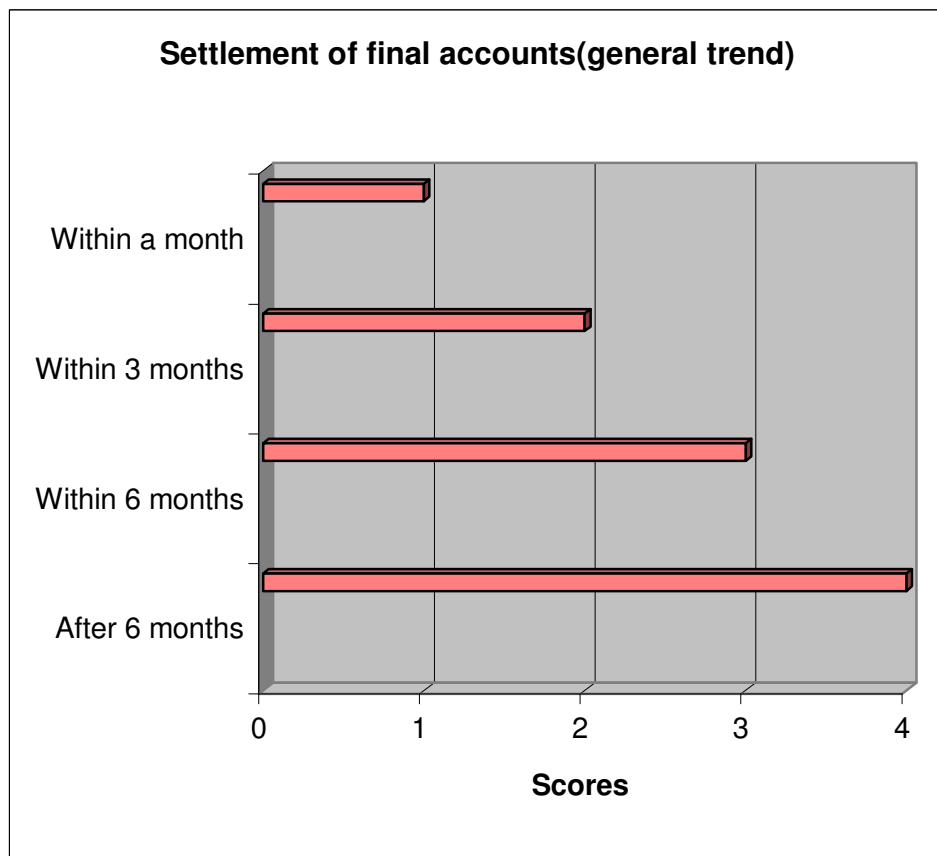


Figure 11. Responses on time for conclusion of final accounts

Note: Some respondents pointed out that the delays could be attributed to contractors.

With regard to the settlement or conclusion of the final accounts, the majority of the projects were never settled within a month and hardly within 3 months after practical completion. Most of the respondents indicated that the final account claims were settled after 6 months when the project was practically completed.

Question 18 was included to determine whether a detailed cost report for the project was prepared after project completion or not. The majority of the respondents indicated that the cost report was done.

Question 19. *What factors do you think attributed to the differences between the original budget and the final account report?*

The last question (19) was intended to confirm the responses for question 8. The differences between the original budget and the final account are shown in the results below.

Description	1	2	3	4	5
	Never	Hardly	Sometimes	Often	Always
Changes in scope of work	0	1	3	8	12
Changes in specifications	0	2	3	8	10
Omission of costs in budget	2	6	7	5	3
Extension of time claim	1	4	1	8	9
Others	3	2	1	1	0

Table 19. Response on the causes of differences between budget and final account.

Note: The bold letter in the table indicates the mode as follows:

<u>Causes of cost variances</u>	<u>Scale rating</u>
• Changes in scope of work	5 (always)
• Changes in specifications	5 (always)
• Omission of costs in budget	3 (sometimes)
• Extension of time claims	5 (always)
• Others	1 (never)

The graph below (figure12) shows the responses.



Figure 12. Causes of difference between budget and final account.

According to the above responses, the opinion of the majority of the respondents attributes the differences to the following factors, which can be summarised in this order of occurrence:

- Changes in the scope of work
- Changes in specifications
- Extension of time claims
- Omission of costs in budget

Other factors named by the respondents include

- Fluctuations in prices
- Statutory decrees
- Lack of client decisions

3.7 Summary

This chapter presented the data of research findings from the population sample as earlier indicated. The findings were subdivided in 2 sections, namely the pre-contract phase of a construction project and the post-contract phase. The pre-contract phase research findings revealed how cost planning was done on projects and the post-contract phase revealed findings on how cost control was done on projects.

CHAPTER FOUR

ANALYSIS AND INTERPRETATION OF THE DATA.

4.1 Introduction.

In this Chapter, the research findings in the preceding chapter will be analysed and interpreted. The objective of this chapter is to evaluate the effectiveness of project cost management on government projects with reference to the population sample in Botswana. This entails analysing the cost planning factors as well as cost control measures from the research findings.

To achieve the above, the analysis and interpretation of data will be done in two sections, as in the preceding chapter on research findings. The two sections are pre-contract and post contract stages.

4.2 Model for interpretation of the data.

The mode as a descriptive statistical tool will be used for the interpretation of the data. The most frequently occurring score determines this measure of central tendency. For example, in the following set of data below,

1 2 3 4 4 5 6

The mode is 4, because 4 occur more frequently (2 times) than any other number.

Although as a measure of central tendency, the mode is of limited value, it has been used in this research because it is appropriate for data on nominal, ordinal, interval and ratio scale (Leedy, P.D. 2001:267). This is the same data that has been gathered in the research.

4.3 Pre-contract stage – Analysis and interpretation of the data.

This is the cost planning phase of the construction project and it is very critical. Ideally, when the project is planned carefully, success is likely (Kerzner, H. 1998:89). This entails that, successful

management of costs on construction projects is linked to good planning and taking into account all the factors that may cause cost variances.

The analysis and interpretation of the data from the research findings are shown in the next sub-sections.

4.3.1 Cost planning factors.

Having stated that effective cost planning should incorporate the necessary information at project initiation, the following is the hierarchy of the factors included when determining the project cost plan and the extent as perceived by the respondents.

The following extent of the respondents' opinion is an adaptation from, figure 4 and table 3 of chapter 3.

Factor	Extent of respondents opinion
1. Project specifications	100 %
2. Statement of work (brief)	80 %
3. Work breakdown structures	60 %
4. Milestone schedules	60 %

Table 20. Ranking of cost planning factors used in project cost plan.

From the results in table 19, it is evident that the above cost planning factors are included in the project cost plan. However, the extent varies as stated in the same table (table 19). The majority of the respondents indicated that priority is given to the project specifications and the statement of work with regard to the project cost plan.

According to the above findings, most of the construction professionals put more emphasis on the project specifications and

the statement of work than the breakdown structure of the cost plan. The least factor of concern is the milestone schedules. This indicates that the budget for the project attaches less importance on the time parameters of how costs will be incurred later. The importance of time, as emphasized before, should be noted. Therefore, effective cost planning should be linked with time, which seem to receive less priority according to the research findings. Without the time parameter on the project costs, it eventually becomes difficult to coordinate and manage costs during the life cycle of the project.

The findings, in question four of the questionnaire, which was intended to correlate the results in question one, were similar. According to the respondents, the project cost plan (budget) was linked to the cost planning factors in a similar manner as the hierarchy of importance of these factors (refer to Figure 7 of chapter3). The project specifications and the statement of work were regarded to be more important than the other factors.

4.3.2 Analysis of the specifications and employer's brief.

According to Cleland, D.H and Ireland, L.R (2002:328), a statement of work describes the actual work that is going to be performed on

the project which, when combined with the specification, usually forms the basis for the contractual agreement on the project.

These have consequently many cost implications to the project. If misinterpreted, it can result in cost overruns and ultimately cause cost management to be ineffective due to large cost variances from the budget.

The research findings showed the following results as the best description of the brief provided by the employer according to the consulting professionals' opinion (Table 4 and figure5 of chapter 3)

Brief description	Grade of respondents opinion
Clear and Precise	50 % (sometimes)
Confirms project requirements	25 % (hardly)
Properly defines the scope	50 % (sometimes)

Table 21. Percentage description of the employers' brief.

The above research results indicate that the brief provided by the employer on the projects covered by this research was inadequate. The inadequate brief can increase the project costs because of the inevitable changes.

The project cost plan (budget) is very much linked to the brief (SOW) and the project specifications, which are inadequate. This causes high possibilities of cost variances to the project during project execution.

Furthermore, the research findings (refer to table 5, chapter3) indicated that the project specifications were hardly completed when the project cost plan was determined. This could lead to a lot of variances on the project during the execution stage when the project information is provided.

4.4 Post-contract stage – Analysis and interpretation of the data.

At this stage, the project is undergoing the execution phase. It is at this stage that the process of comparing the actual performance with planned performance in terms of cost is done, as emphasized by the PMBOK (2000:91).

From the research findings (table 7, chapter 3) an affirmative response of 91.3% from the respondents indicated that cost were not incurred has planned, hence the critical need for project cost control. Cost control entails controlling the changes that affect the project budget and take corrective actions before it is too late. It is not meant for only “monitoring” the costs and recording perhaps massive quantities of data.

4.4.1 Cost variances and approvals.

In terms of the approval of cost variances by the employer or representative, the majority of the respondents indicated that the approval was done (table 8, chapter 3). The response indicates that, not only was the employer informed of the cost variances he also approved the cost variances on the projects. This indicates good change control for it ensures that the changes are captured and approved by the designated people.

With reference to when the employer was informed of the cost variances on the project, the responses varied. On some projects, the responses were that the employer was informed of the cost variances before the changes were executed while on the extreme, the employer knew about the cost variances at final account stage. (refer to table 9, chapter 3). This entails that there was in

consistency at what stage, the employer was informed of the cost variances. It seems it was done on ad hoc basis.

4.4.2 Causes of cost variances

The research findings in the preceding chapter indicates that, the major causes of the cost variances were ranked in the following order:

1. Change in the statement of work
2. Change in the specifications
3. Extension of time claims
4. Omission of costs in budget
5. Others

The above order indicates that the major cause of the cost variance was the change in the scope of work, followed by the project specifications. These results can be linked to the initial employer's brief. As established earlier, the brief by the employer on the projects in this research was inadequate. Because of the inadequate statement of work, it is inevitable that changes occurred to the projects requirements such as end user requirements or just change of mind. Consequently, these might have contributed a great deal to the cost variances.

In line with the brief, the PMBOK (2000:57) emphasises that, where there is poor scope definition (SOW), final project costs can be

expected to be higher because of the inevitable changes which disrupt the rhythm, cause rework, increase project time, and lower the productivity and moral of the workforce.

The other causes of cost variances can also be linked to the inadequate brief. Usually where the scope is inadequate, for example, the specifications will not be complete. This may cause cost variances at a later stage when the specifications are confirmed.

Furthermore, the time for the execution of the works will increase at the employers account. Consequently, there could be indirect costs to the project with regard to the time parameters in the form of extension of time loss and expense claims.

4.4.3 Cost reporting analysis

If a project is to be successfully completed within the budget, all relevant project participants must be kept informed about the status of the project in terms of costs.

In this research, all the respondents indicated that cost reporting was done on all the projects under consideration. It was further indicated that the cost reports were standardised. The

standardisation of the cost report format was clarified further as format per firm. The employer (Government through PPADB) did not provide a standard format for cost reports. Hence, the contents of the cost reports were dependent on the consulting professional on each particular project.

In terms of the frequency of the reports, 95% of the respondents indicated that the reports were done every 3 months. It appears that this was a standard requirement on those projects since they were for the same employer.

From the responses of question 12 (table 13, chapter 3), it appears that the contents of the report emphasises on the actual cost expenses. The majority of the respondents included cost variances (tabular format) in the cost reports. Only 26% of the respondents indicated that schedule variances were indicated in the cost report.

Furthermore, the presentation of the cost report appeared to be inadequate by the majority of the respondents. With reference to table 13, 74% of the respondents indicated that they did not include graphs in the cost report. It should be noted that, for communicating project status, various schedules, graphs are essential. The information in the cost report should indicate project status clearly to allow for decision-making. It should be noted that, cost reports

are only effective if they are submitted to the right people at the right time to facilitate decision-making.

4.4.4 Responsibility or Involvement in cost reporting.

The response of 95.6%(table 14, chapter 3) of the respondents indicated that the consulting professional on projects responsible for the cost reporting was the Quantity Surveyor. Although the lead consultant or Principal Agent is responsible for the management of the whole project, it appears that the cost aspect of that responsibility was delegated to the Quantity Surveyor. In as much as the Quantity Surveyor is the cost expert on the project, final responsibility for overall cost reporting should rest on the Principal Agent. Ideally, the Quantity Surveyor should compile a draft cost report or recommendation and submit it to the Principal Agent who should prepare an overall cost report to submit to the employer.

Regarding cost control, the hierarchy of involvement in project cost control, the research findings (figure 9, chapter 3) is indicated below:

	Level Of involvement	Ranking
Quantity Surveyor	100%	1
Architect (principle Agent)	75%	2
Mechanical Engineer	25%	3
Electrical Engineer	25%	3
Civil Engineer	25%	3
Contractor	25%	3

Table 22: Extent of involvement in cost control on projects.

Cost control on a project should involve every one, although to greater or lesser degree, depending on somebody's function on each project. The above results according to the respondents indicate that, regardless of the section of the project, everyone was involved in cost control, which is positive action. Ideally, the success of cost control is dependent on involvement of every party on the project.

4.4.5 Analysis of settlement of claims.

According to figure 10 of chapter 3, 67% of the respondents indicated that contractual claims were settled soon after occurrence. 33% of the respondents indicated that the contractual claims were settled after completion of the project. This suggests that, in as much as some claims were settled after occurrence, more were settled after completion.

Regarding the conclusion of final accounts, some of the respondents' perception was that of never concluding them within a month after practical completion. The trend was that, more final accounts were agreed and concluded as months increased (refer to figure 11, chapter 3). The majority indicated that most of the projects' final accounts were agreed and concluded later than six

months upon completion of the project. Some of the reasons for this delay were attributed to contractors.

The above suggests that the delay in the settlement and conclusion of final accounts was due to non-settlement of contractual claims as soon as they occurred during the execution of the project.

Despite the delays in the conclusion of the final accounts, final cost reports were prepared on the projects.

4.5 Summary.

This chapter focused on the analysis and interpretation of the data from chapter 3. It was subdivided in two sections.

The first section analysed data regarding project cost planning. It revealed that although cost planning factors are incorporated in the cost plan (budget) of projects, there was inadequate information for effective cost planning purposes.

The second section focused on the post contract phase of a construction project. In this section, the data revealed that there were cost variances on projects, which were mostly associated to changes

in the scope of work and specifications. These could be linked to inadequate information when the costs were planned.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

5.1 Introduction

In this study, the main objective was to evaluate the effectiveness of project cost management for public works in Botswana. As already established, managing costs is one of the essentials of project management (Spinner, M.P. 1997:113). A project is said to be successful if its completion is within the parameters of time, cost and quality, including customer relations.

In order to evaluate how costs are managed, this study focused on the following aspects:

- How project costs are planned.
- How project costs are controlled and analysed.
- How project costs are analysed at completion of a project.

5.2 Summary

The first chapter was an introductory part of the study. As a general background to the study, it was emphasised that one of the key

parameters that attribute to the success of a construction project was completion of a project within the budget (cost parameter). However, it was stated that there are cost overruns on Botswana government projects and the study evaluated the cost management on category “D” projects completed in the last five years.

Chapter 1 stated the problem with four sub-problems. Each of the sub-problems had a hypothesis to be tested. The delimitation, assumptions, research methodology and the importance of the study were also stated in this chapter.

Chapter 2 dealt with the review of related literature on the subject. Due to limited literature, specifically applicable to Botswana, a critical analysis of what other researchers found in other countries was incorporated in the study. This chapter covered the ideal project cost management as analysed by different researchers and authors.

The major aspects discussed were:

- Project cost planning
- Project cost control and
- Financial project closure at completion.

Chapter 3 dealt with the research methodology of what data was collected, where it was collected from and how it was collected. In this chapter, the data collected was presented as research findings.

In chapter 4, the data collected in chapter 3 was analysed and interpreted. The weaknesses and limitations to the research findings were pointed out as well.

In this chapter (5), a summary, conclusions and recommendations are covered. It also states the main lessons learnt from the research.

5.3 Conclusions

Sub-problem 1

To determine the extent to which cost planning factors are incorporated in cost planning techniques used in public works projects. (To what extents are cost-planning factors incorporated in cost planning techniques used in public works projects?)

From the responses to the questionnaires and the analysis thereof in chapters 3 and 4, the following can reasonably be deduced:

The cost planning factors included in the project cost plan are as stated below, starting with the one, perceived to be the most important:

1. Project specifications
2. Statement of work (brief)
3. Work breakdown Structures
4. Milestone schedules

The first two (perceived to be the most important factors) were not complete at the time when the cost plan was prepared; therefore they are one of the major causes of cost variances to the original cost plan (budget).

Milestone schedules are perceived to be the least important cost planning factor in cost planning. Hence, it can be one of the causes of indirect costs leading to cost overruns on a project if it is not monitored.

Hypothesis to sub-problem 1

Cost planning techniques exist for public works but they are not effective due to inadequate description of the projects' scope of work, which is one of the major cost planning factor.

The analysis and interpretation of the research findings regarding sub-problem 1 supports this hypothesis. The reason for this is that, although cost planning factors were incorporated in the cost plan, they were not effective due to the fact that the statement of work (scope) and the project specifications were not complete when the cost plan was determined.

Sub-problem 2

To identify significant factors that influences construction cost overruns on public works projects. (What significant factors influence construction cost overruns on projects?)

The significant factors identified in the research that cause cost variances stated in the following perceived order of significance:

1. Change in the statement of work
2. Change in the specifications
3. Extension of time claims
4. Omission of costs in budget

Hypothesis to sub-problem 2

The main causes of cost overruns are changes in the scope of work and project specifications.

The research findings and analysis supports this hypothesis to a large extent. This is because, the identified major causes of cost overruns include, the changes in the scope of work and project specifications.

Sub-problem 3

To analyse the cost control measures that are used on public works projects. (What cost control measures are used in public works projects?)

The research revealed that cost analysis of the variations was done mostly at the time when the contract variations were executed /or after being executed and the employer was informed thereafter. It can be reasonably deduced that, cost analysis was done at the time when it was too late to make decisions for alternatives.

Hypothesis to sub-problem 3

Future project costs are not adequately analysed and reported, causing cost control measures to be ineffective.

The research findings and analysis supports this hypothesis to a large extent. This is because future costs were not analysed before they occurred, and only to be analysed while being executed or after. Hence, what was done on projects is cost monitoring and mere bookkeeping of performance in terms of costs, instead of cost control.

Sub-problem 4

*To determine what constitutes financial completion of a project within the budget in an effective project cost management system.
(What factors entails financial project completion?)*

The financial completion of a project entails settlement of contractual claims and agreeing the final accounts. From the research findings and analysis, it can be concluded that,

- Final accounts were agreed and concluded in six months or more after practical completion of a project.

- Final cost reports were prepared for the project after the completion.

Hypothesis to sub-problem 4

The project cost management system can be modified to suite specific projects that can lead to successful financial project control and completion.

From the research findings and analysis, the research does not support the hypothesis. This is with specific reference to cost report format each firm used on different projects. The overall cost management system proved to be inadequate. Hence, the need to have a standard format or requirements in a project cost management system.

5.4 Recommendations.

5.4.1 Research recommendations

Having undertaken the study, the following are the recommendations that would improve on the effectiveness of project cost management for public works in Botswana.

1. The government should have a detailed brief and project specifications. These should be clear and concise to confirm the project requirements, especially, as most of the government construction projects are standardized. This will lessen the cost variances, which are being experienced due to inadequate statement of work (scope) and specifications.
2. There is need to put more emphasis on milestone schedules as a cost planning factor. This is because this time parameter has indirect cost implications that should be accounted for especially, when changes are made.
3. The approval of cost variances by the employer or representative should be encouraged. However, this should be done before the changes are executed so that the employer has the opportunity to make decisions and consider alternatives.
4. In terms of cost reporting, there is a need to have a standard format of presenting the cost reports for projects. It should specify the contents, requirements and how the report should be presented. Graphs should be included in the report so that

the employer can easily grasp the project status and make decisions.

5. The lead consultant, who is the Architect according to the current procurement system, should be responsible for project cost reporting. The Quantity Surveyor (cost expert) should compile the report with support from other consultants.

6. The contractual claims and final accounts should be settled and agreed as soon as they occur or has stipulated in the contract. In most of the contracts, the period of final measurement and conclusions of final accounts is not more than six months after practical completion of a project. For example:

- JBCC clause 34.1 allows for ninety (90) working days after the date of practical completion for the final account to be prepared by the principal agent.
- The Botswana BIPD contract allows for 6 months from the day stated in the certificate of practical completion of the works (if not stated in the contract appendix).

7. Final project cost reports should always be compiled and reported complete with cost variances, analysis and comments (Earned value format is recommended). After this report, a post-mortem investigation should be conducted to compare the actual expenditure with the original estimate, which is helpful in pointing out mistakes to be avoided when estimating or executing future projects.

5.4.2 Recommendations for future research

The following are the recommendations for future research:

1. A similar study to this one could be undertaken to evaluate the cost management on other categories of projects.
2. An evaluation of the cost impact of the changes in the scope of work and specifications on the overall budget on public works project in Botswana.
3. The assessment on the viability to use earned value as a cost management system on Botswana public works projects.
4. An evaluation of project cost control on projects in Botswana.

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Dear sir/Madam,

**AN EVALUATION OF CONSTRUCTION PROJECT COST
MANAGEMENT FOR PUBLIC WORKS: A CASE OF BOTSWANA.
QUESTIONNAIRE.**

The purpose of this study is to obtain your views on how cost management is done on construction projects in Botswana. The results could be of benefit to stakeholders in the construction industry in general.

In recognition of this, your organisation has been selected to provide information, which will form part of a treatise towards partial fulfilment of the requirements for a master's degree in Project Management at the University of Pretoria, RSA.

Kindly afford us some time to complete and return the attached questionnaire, together with your evaluations.

All information pertaining to your organisation will be treated as strictly confidential. There will be no reference to you as source of information whatsoever.

Your participation and inputs are essential and will be highly appreciated.

Yours faithfully,

Gert Basson
Study Leader and
Programme Leader for MSc. (Project management)

Harrison Njamu
Student / Researcher.