

**DEVELOPING A PREVENTIVE COST CONTROL  
MODEL BY UTILISING  
EARLY WARNINGS AND RISKS**

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EARLY WARNINGS AND RISKS**

**by**

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# **MEMBANGUNKAN MODEL KAWALAN KOS SECARA PENCEGAHAN DENGAN MENGGUNAKAN AMARAN AWAL DAN RISIKO**

## **ABSTRAK**

Kajian mengenai kawalan projek (terutamanya kawalan kos) hanya mendapat perhatian yang terhad di Malaysia. Sistem kawalan kos secara konvensional adalah pada asasnya berdasarkan kepada konsep pembetulan di mana masalah projek mungkin telah berlaku dan syarikat mengalami kerugian. Suatu sistem kawalan projek yang berkesan mestilah mampu meramalkan masalah yang berkemungkinan akan berlaku, yang tidak terdapat di dalam kaedah projek klasikal di mana permasalahan telah wujud. Amaran awal boleh dimasukkan sebagai sebahagian daripada pengurusan risiko projek kerana “masalah” dan “risiko” boleh dikaitkan di antara satu dengan lain. Tujuan kajian ini adalah untuk membangunkan suatu model kawalan kos menggunakan pendekatan pencegahan untuk digunakan oleh kontraktor untuk menghapuskan atau mengurangkan perbelanjaan yang tidak perlu.

Penyelidikan ini yang berdasarkan kepada industri pembinaan menumpukan kepada penggunaan kawalan kos selepas tender dikeluarkan dan semasa pembinaan. Penekanan yang besar telah dilakukan di dalam menganalisa pengalaman responden berkaitan dengan kawalan kos dan amaran awal. Penyelidikan ini akan mengenalpasti tanda-tanda amaran awal, masalah projek dan juga risiko di dalam usaha untuk memperkenalkan konsep kawalan kos pencegahan dengan menggunakan amaran awal. Penyelidikan ini berusaha untuk mengambil kira amaran awal sebagai penambahbaikan prosedur kawalan kos konvensional. Metodologi yang digunakan adalah kualitatif keseluruhannya menggunakan pendekatan teori “*semi-grounded*” dan data utama dihasilkan daripada menemuduga tiga puluh syarikat pembinaan. Pendekatan methodology ini dipilih kerana amaran awal adalah konsep yang baru secara relatif di dalam industri pembinaan Malaysia dan data yang dikutip adalah berkenaan ekspresi pengalaman dan

perasaan responden berkenaan amaran awal dan kawalan kos. Analisa teori “*grounded*” dilakukan bersama dengan analisa risiko dan analisa amaran awal.

Tiga model dibangunkan, satu dari literatur, satu dari data utama dan satu lagi merupakan model teoretikal yang dicadangkan. Dua puluh enam jenis amaran awal dari industri pembinaan Malaysia dihasilkan dan penyelidik telah mengenalpasti kerosakan peralatan dan kenaikan harga bahan sebagai berisiko tinggi. Juga dihasilkan dari kajian ini adalah kebanyakan contoh amaran awal adalah berpunca dari kategori pengurus projek & pengurusannya dan pemilihan sumber-sumber, dan ini akan menjurus kepada permasalahan berkaitan dengan kerosakan peralatan dan prestasi subkontraktor.

**Katakunci: Kawalan Kos, Amaran Awal, Tindakan Pembetulan, Risiko**

# **DEVELOPING A PREVENTIVE COST CONTROL MODEL BY UTILISING EARLY WARNINGS AND RISKS**

## **ABSTRACT**

The study of project control (cost control in particular) has only received limited attention in the Malaysian construction industry. The conventional project control system is basically corrective based, where project problems may have already occurred and the company may have experienced losses. An effective project control system must be able to anticipate emerging or unforeseeable problems, a deviation from the classical project methods which are often slow where problems may already exist. Early warnings can be included as part of the project risk management theories because “problem” and “risk” are apparently related to each other. The aim of this study is to develop a preventive cost control model that can be adopted by contractors to prevent or reduce unnecessary cost overruns.

The research which is based on the construction industry addresses the utilisation of cost control after award of tender and during construction. Major emphasis has been placed on analysing the experiences of the respondents with regards to cost control and early warnings. This research will identify early warning signals, problems and risks in an attempt to introduce the concept of preventive cost control utilising early warnings and risks. This research attempts to incorporate early warnings as an enhancement to the conventional project cost control procedures. The methodology undertaken is wholly qualitative utilising the semi-grounded theory approach and primary data collected from interviews performed on thirty contracting companies. The grounded theory methodology is preferred because early warnings is a relatively new concept in the Malaysian construction industry and the data to be collected is concerned about expressions of the experiences and feelings of the respondents regarding early warnings and cost control. Grounded theory analysis is performed with risk analysis (risk assessment matrix tables) and early warnings analysis (early warnings, cause, problem relationship).

Three models were developed, a model from literature, a model from primary data and finally a proposed theoretical model. Twenty six main types of early warnings from the Malaysian contracting industry were also developed and the researcher has identified equipment breakdown and price increase of materials as high risk events. It was established from the research that most early warning examples came from the project manager & his management and the selection of resources categories, and these were found to lead to problems related to equipment breakdown and subcontractor performance respectively.

**Keywords; Cost Control, Early Warnings, Corrective Action, Risks**



# **CHAPTER 1.0: INTRODUCTION**

## **1.1 Research Background**

The classical project control concept emphasises on corrective-based procedures which can contribute to unnecessarily cost expenditures to the contractor. Whilst most project problems are manifested and identified, their very existence indicates unsatisfactory management skills requiring extra costs to remedy. The contribution of this research is to develop models from literature and primary data, and (subsequently) a proposed model for controlling the cost of construction projects by adopting prevention as an approach as opposed to the currently widely practised conventional corrective measures. The prevention of cost overruns will mean the prevention of risks from materialising into problems and this will be analysed with the utilisation of risk analysis and early warnings.

Project control and cost management in the construction project environment have been the subject of a myriad of studies. Project control which has been studied by Albonetti & Gatti (1986), Miskawi (1989), Diekmann (1992), Gardiner & Stewart (2000), Nikander (2002) and Rozenes (2002) basically attempts to enhance the current overall project control procedures. Cost management is a wide discipline of study, which can further be subdivided into categories such as cost control, cost estimation and total cost management. Researches have been carried out specifically in the field of construction cost control by Belivieu (1984), Abu-Hijleh et. al. (1993), Hastak et. al. (1996), El-Choum (2000), Wang (2002), Kim (2002), Al-Jibouri (2002), and Bender (2000).

All projects are not without problems. The later, project problems are identified (especially when an activity within which the problem arises, is nearing completion), the higher will be the costs to correct it. Current thoughts and practices on project control are mostly based on corrective measures. This is evident in existing researches (Diekmann,1992; Abu-Hijleh et. al., 1993; Hastak et. al., 1996; Wang, 2002; Kim, 2002; Al-Jibouri, 2002) and systems that only focus on developing performance standards (e.g. budgeted costs or budgeted time), calculating and comparing the variances of items of work that has already been carried out ( Nikander & Eloranta, 2001). They are not able to prevent the occurrence of potential problems, which is one of the vital attributes of any project control process.

Academically and professionally current thoughts and practices on construction cost control are also mostly corrective based. There are very limited studies on cost control (or project control generally) based on the preventive approach. The works of Bender (2000) and Nikander (2002) are such examples, utilising risks and early warnings respectively, although the work of Nikander is not specifically focussed on cost control but on project control generally. Because the materialisation of risks within a particular time frame is unknown, risk management approaches lack the vital information of the exact (or estimated) moment of materialisation of risks. Early warnings can be utilised to determine this, therefore, the works of Bender and Nikander can be made even more effective if their individual concepts of risks and early warnings are merged together to produce an even better cost control system.

In Malaysia, cost control is inevitably based on the conventional and established corrective methods. The larger contracting companies (e.g. those listed on the Bursa) will have clear guidelines and strategies to cost control and they utilise more sophisticated software such as the Primavera for planning and cost control where software experts will sometimes be employed. The Microsoft Project software will be mostly available to the medium to small sized contractors. Clients usually request for project plans (schedule and cost plans) before they start work. These can readily be obtained from Primavera and Microsoft Project after all data have been inputted. For smaller contractors (CIDB classification G1, G2) these planning data although submitted to the client, are not being utilised for control purposes by the contractors themselves. Cost control has not been taken seriously by smaller and some medium sized contractors as was the case with Charoenngam & Sriprasert (2001), Ogunlana & Butt (2000) and Dalakleidis (2001) who found out the same in Thailand, Pakistan and Greece respectively. An academic research was carried out by Mansur & Mohamad (2006) to develop an assessment tool for monitoring project performance which clearly falls under the category of project (cost) control by corrective action.

Although cost control based on performance is a significant advancement in project management, it could be made more effective if managers would give increased consideration to the cost impacts of decisions at the time or before they are made, in other words, cost is most effectively managed before it occurs (Medley, 1994). Therefore the lack of academic works and industry inadequacy in addressing cost control can be reflected in:

- 1) failure in detecting problems early enough to minimise excessive cost overruns by adopting corrective action procedures. (Nikander, 2001)
- 2) project cost control procedures having an inordinately long response time after which nothing can be done as a particular activity has been completed. (Harris & McCaffer, 1992)
- 3) cost reports which serve only as historical documents because they are only useful for future projects and not for the current project (Medley, 1994).

Figure 1.1 indicates the classical project cost control concept of monitoring and taking corrective action which is the basis of most researches undertaken in the discipline of project control. A problem may be detected when an activity is still commencing or only realised when the activity has been completed.

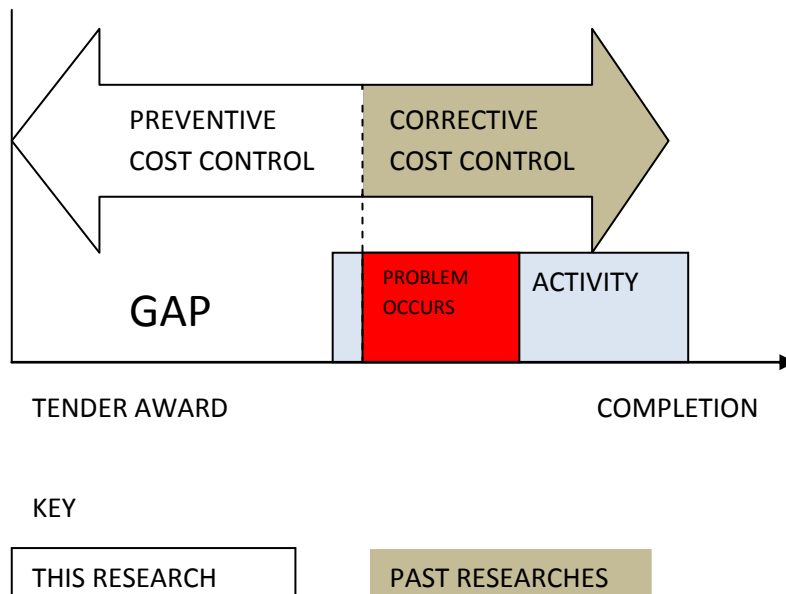


Figure 1.1: Preventive and Corrective Cost Control.

An enhancement to the traditional concept would be the prevention of problems occurring in the first place, thus eliminating or reducing the need for corrective actions and unnecessary expenditures, in agreement with the well-known saying “prevention is better than cure”. A project control system must be able to anticipate emerging or unforeseeable problems, a deviation from the classic project methods which are often slow where problems may already exist. (Nikander & Eloranta, 2001). In the present context of project control theory it is absolutely vital to obtain advanced information about potential project problems.

Given that there are gaps (refer to Figure 1.1 on page 4) in the existing literature on various issues pertaining to project control or specifically cost control, and being cognizant of the studies by Nikander & Eloranta (2001), there is a need for a new holistic understanding of project control and into the manner and circumstances in which this very important and dominant area of construction management to be further improved. The focus of the research is on construction project cost control with the aim of delivering profitable projects for the contractor.

An improved cost control model and a theory linking cost control, early warnings and risk will be developed. The model which will be based on a preventive approach to cost control utilising early warnings and risk will also incorporate the conventional form of cost control. This will reduce the contractors unnecessary cost overruns (and increase profits) because project problems will be eliminated before it actually happens.

## **1.2 Research Questions, Aims and Objectives**

Cost control is about controlling expenditure to prevent over expenditure. In the context of the present literature, most cost control systems are corrective in nature, this study will endeavour to establish a preventive procedure to cost control by managing early warnings, after the award of tender through into the construction stage, to control cost overruns. The aim of this study is to develop a preventive cost control model that can be adopted by contractors to prevent or reduce unnecessary cost overruns, through a semi-grounded theory process.

Specifically the research questions driving this research are:

1. What are the current construction project cost control practices?
2. Can information of the type of Nikander's 'early warnings' be found in construction project work in Malaysia?
3. How can cost overruns (unnecessary non-claimable expenditures) be prevented or minimised in an attempt to improve the current cost control procedures?

The objectives of this research are:

1. To identify the current methods contractors use to control construction costs.
2. To identify and categorise the early warnings, risks, problems and causes that contractors have experienced.
3. To establish the Early Warnings, Project Problems and Project Causes relationship.
4. To enhance the current cost control procedures by producing a model incorporating early warnings and risks.

### **1.3 Research Method**

A qualitative research methodology using a semi-grounded theory was selected for this study. A semi-structured interview approach was conducted on thirty respondents (30) comprising of project managers or engineers representing their respective companies involved in construction projects in Malaysia. Some risk analysis was performed on all project problems to establish their risk ratings.

#### **1.3.1 Literature Review**

Literature review is carried out to identify the gap in the research. The review explores project control generally and cost control specifically as presented by academicians and professional practice. Special attention is given to the preventive approach to cost control by utilising early warnings and risks. Chapter 2 and 3 is dedicated to a review of the literature. The role of literature review in grounded theory is, however, explained in Section 5.1 and Section 5.2 of Chapter 5.0.

#### **1.3.2 Development of Research Ideas**

The development of the research ideas had evolved from the understanding of the issues in cost control and the extension of current works in project and construction management emphasising in project and cost control. Chapter 4 describes the development of the research ideas.

### **1.3.3 Methodology**

The methodology undertaken is wholly qualitative, from data collection through company interviews and the analysis of the results using grounded theory. Company interviews were carried in three separate stages where the interview guide will be updated during each stage as categories reaches theoretical saturation.

### **1.4 Scope of Work and Limitations**

Controlling costs for construction projects starts early in its life cycle from the inception stage through to the post construction stage. This study is, however, focussed on the contractor's cost control after the award of tender through to the construction stage until construction ends as illustrated in Figure 1.2 (on page 9). It will mainly be focussed on the category of cost overruns (experienced by the contractor) that can be prevented and non-claimable from the client.

This study is intended to exclude the cost control methods practised by clients and consultants in the pre construction and post construction stages. It will also exclude cost control procedures related to the accounting and financial management of the company. The project party under study is the contractor and the project phases under investigation are the planning phase after the award of tender and the construction phase before handing over. This is because the contractor is the main player during the construction process and the construction phase is the phase that potentially has the greatest ability to cause budget overruns (Halpin & Woodhead, 1998). The project



problem main categories under study are labour, materials/supplier, plant/equipments and subcontractor.

Only contractors of category “G7” under the classification of contractors by CIDB and class “A” under the classification by the Contractor Service Centre (Pusat Khidmat Kontraktor or PKK), will form the sampling frame, as only larger companies are financially capable of utilising any effective cost control system.

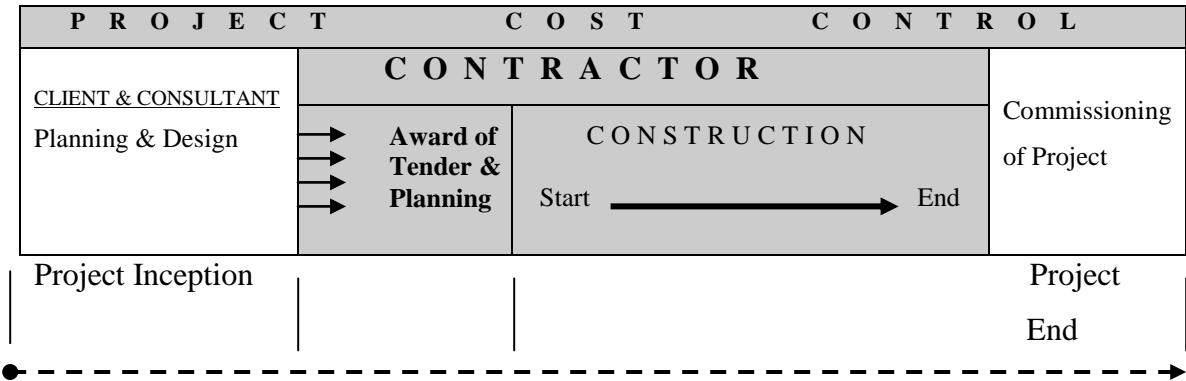


Figure 1.2 Project Cost Control (Shaded Portion Shows Research Area).

**1.5 Significance of Study**

In spite of the important role cost control plays in the construction industry, no published study explored the methods being utilized by contractors in the discipline in Malaysia (CIDB, 2001). The vast number of registered contractors of about 70, 000 in the country ( CIDB, 2001) and the limited number of projects available means that competitive bidding has started to play an important role in projects awarding, and a sound cost control system is vital to ensure maximum profitability once projects are successfully awarded.

Cost control is fundamental for contractors, one reason being profitability. It is no doubt one of the main agenda for contractors as profit is one of the main factors that sustain any organisation business, so this study will benefit the contracting organisation. To ensure continuing profitability, especially in the context of today's unstable and unpredictable economic market environment, contractors must be as proficient and cost effective as possible. Every minute longer that it takes to build anything, can cost the contractor dearly. With the remark that cost control is one of the major control elements in construction projects, there seems to be a need in investigating into this rather important discipline of construction management.

Charoenngam & Sripraset ( 2001) in their study has found out that contractors in Thailand are forced to bid at illogically low prices which has bounded them to focus more on cost control during the construction phase. Fleming and Koppelman (1994) also highlighted that there is a need to develop a more effective cost control system providing managers with an early warning signal and allowing them to take the necessary corrective actions when more money is being spent than earned in any worked item.

The outcome of the present study will benefit the academia profession and those in the practising profession as follows:

- a) Corporate managers, business practitioners, engineers and academicians by enhancing their awareness of the materiality of cost control in an organisation,

and providing some insights into the prerequisites of a successful cost control procedure and the dynamics of such cost control practices and processes.

- b) Students and researchers by enlightening them on some basic facts about cost control practices among Malaysian construction companies. This should provide the impetus and serve as an important source of reference for future discussions and a starting point for future researches on the subject.
- c) The body of knowledge by strengthening the existing theory and practices on which most discussions in respect of cost control rest, i.e. management by exception. The outcomes of the current study will be crucial not only in filling the void in the existing literature but most importantly in justifying the position of preventive cost control within the current cost control practices.

## **1.6 Organisation of the Thesis**

The thesis has nine chapters. The first chapter provides a background of the study that incorporates such aspects as the definition of cost control and its various dimensions, the identification of research problems and objectives, the discussion on the significance of and the delineation of the scope of study.

The second and third chapter expounds on the various findings of prior studies especially in respect of project control and cost management in relationship with cost

control with a view of identifying the variables of interest and thereon, addressing the issue of improving cost control.

The fourth chapter attempts to develop the cost control models through the research process.

The fifth chapter deals with the issue of methodology. It covers three main areas namely research design and the analytical approach used in the study. Specifically the discussion includes such topics as purpose of study, types of investigation, study setting, choice of respondents and the instrument of study.

The sixth, seventh and eighth chapter provides the results of the analysis and the discussions on the results. The last chapter is devoted to synthesizing and summarizing all outcomes of the study and explaining their practical and academic implications. It also discusses the conclusion and recommendations for further work.

## **1.7 Summary**

This chapter has provided an overview of the broad concept and significance of project control specifically cost control and highlighted the voids in existing literature that has prompted the current research undertaking. Specifically, it has identified and put in perspective the various research problems, the objectives, the significance and the scope of the study. It has also discussed the organisation of the thesis. In the next chapter the focus of discussion will be on the main outcomes of prior studies and

literature contributions in the area of project control specifically cost control focussing on the current and preventive procedure for cost control.

## **CHAPTER 2.0: CONSTRUCTION COST CONTROL**

### **2.1 Introduction**

The estimated cost of a project can be altered without major difficulties early during the project life cycle, due to no major undertakings being committed at this stage (refer to Figure 2.1 on page 15). When construction begins the budget which is a conversion from the estimate, is fixed and acts as the baseline for the contractor to control costs. Any client-directed alterations to the project at this stage will result in substantial cost increases to the client. The responsibility of the contractor to the client is to carry out the works according to the specifications, cost and schedule. The contractor at this stage is faced with one of the most difficult task in construction management as this is the phase that potentially has the greatest ability to increase the planned budgeted costs (Halpin & Woodhead, 1998). With maximum profit in mind, because the goals of any business cannot be achieved without profit, the contractor will have to turn to cost control for assistance.

However, most cost control systems/procedures in practice are based on the concept of management by exception where the problem (cost overrun) has already taken place and nothing much can be done to recover the losses (Halpin, 2006; Nikander & Eloranta, 2001). Logically, prevention of the cost overruns from ever occurring will be a better option which is the main subject of this study.

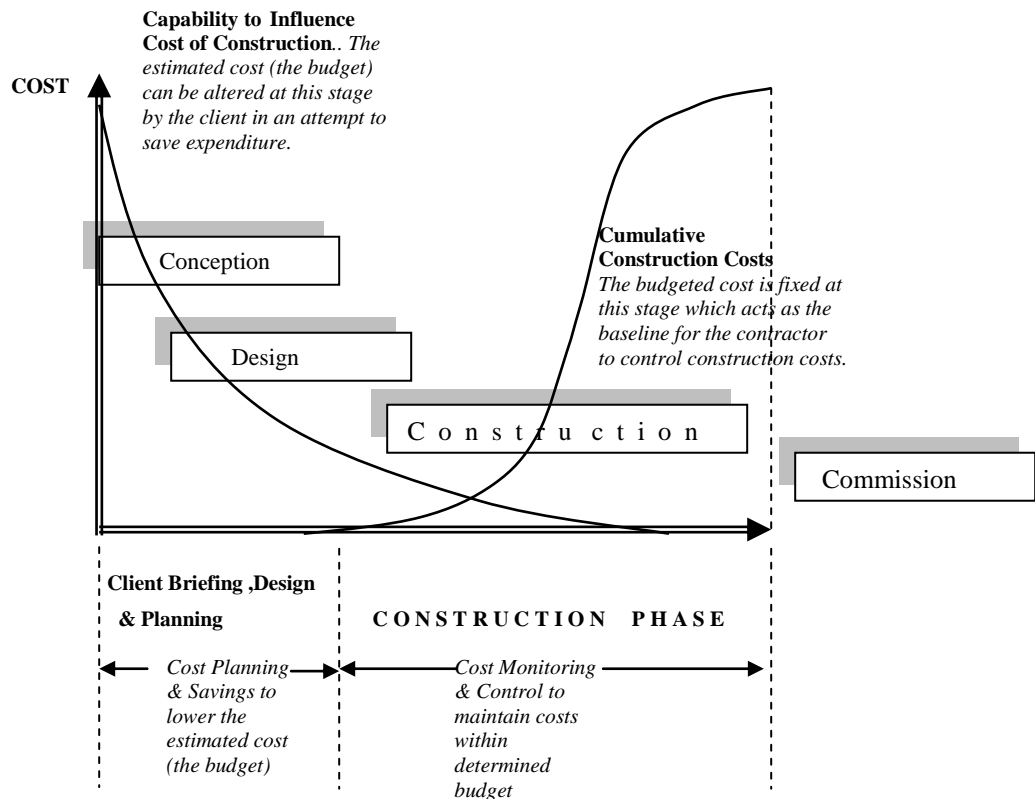


Figure 2.1 Capability to Influence Cost of Projects.

Source: Adapted from Cost & Value Management in Projects (Venkataraman & Pinto, 2008) ; Doctoral Thesis (Bender, 2000).

## 2.2 The Project Success Criteria

The success of a project is a somewhat a relative interpretation by those involved, it can be a success for one party but a failure to another. A project can also be a success one day and unsuccessful the next as it is also time dependent. Factors affecting project success or failure frequently cited in project literature are generally time, cost and quality (performance) but equally important and the most appropriate criteria for the measurement of success are the project objectives. The degree to which these objectives have been met determines success or failure, but problems arise when the objectives tend to change for each major phase. Time, cost and quality are no doubt the basic fundamental objectives for a project and conforming to these factors will

determine the project's success but it is not as simple as that when one finds more objectives to be met along the way than just time, cost and quality. One must also consider the objectives of all stakeholders during the project life cycle. Various researches have identified various factors either from experience or research that are thought to be important for the success of projects. Ashley (1986) carried out a study on construction project success and repeatability and the study showed that the likelihood of achieving a project's success is greatly enhanced by putting more emphasis on construction planning effort, design planning effort, project manager goal commitment, project team motivation, project manager technical capabilities, scope & work definition and control systems. The works of Hayfield (1979), Ashley (1986) and Morris et. al. (1987) are presented in the Table 2.1 below.

Table 2.1: Factors Important For Project Success.

FACTORS IMPORTANT FOR PROJECT SUCCESS		
<i>F. Hayfield (1979),</i>	<i>D.B. Ashley (1986)</i>	<i>P.W.G. Morris et al (1987)</i>
<p><u>Macro Factors</u>            *Realistic and thorough definition of project            *Efficient manner of project execution            *Comprehension of the project environment            *Selection of organisation realising project</p> <p><u>Micro Factors</u>            *Formulation of sound project policies            *Clear and simple project organisation            *Selection of key personnel            *Efficient and dynamic management controls            *Reliable management information system.</p>	<p>*Budget performance,            *Schedule performance,            *Client satisfaction,            *Functionality            *contractor satisfaction,            *Project manager / team satisfaction</p>	<p>*Project definition            *Planning and design            *Politics            *Schedule duration            *Schedule urgency            *Finance            *Legal agreements            *Contracting            *Project management            *Human Factors</p>

Sources: Basic Factors for a Successful Project (Hayfield, 1979), New Trends in Risk Management (Ashley, 1986), The Anatomy of Major Projects (Morris & Hough, 1987).



Anton de Wit (1988) has the opinion that measuring success involves an evaluation of the degree to which the objectives have been achieved where the objectives will therefore become the success criteria. With so many objectives in any one project it becomes difficult to determine the success or failure of a project. Anton de Wit (1988) produced a project success framework for an oil field development project from the client's perspective but nevertheless it can also be used to illustrate the relationship between objectives from the viewpoint of the contractor in the construction industry. With various objectives for various parties to a project, of which some are conflicting to each other, it appears to be difficult for a project to be a success for all the parties involved. The study carried out by Anton de Wit (1988) which was limited to the project development phase and with only the contractors as the stakeholders, reveals that technical performance as a measurement of success criteria scores 54%, cost performance 23 % and schedule performance 22 %.

### **2.3 Project Control**

Project control has been the subject of a myriad of studies. Project control is a process and begins with a plan that identifies the objectives of the project with specific checkpoints throughout the project cycle (Gould, 2000). This is the basis of the current project control concept where deviations from the original work plan is noted and adjusted for. A number of researches have been carried out utilising this concept.

A project control system which is able to integrate all known dimensions of a project and also separates the work package and control package into different

breakdown structures was undertaken by Rozenes et.al. (2002). Diekmann & Al-Tabtabai (1992) used knowledge based system which will help the project manager in the diagnostic and prescriptive aspects of project control. Miskawi (1989) produced a series of S-curves of various projects for project control and found out through a variety of tests that the equations for the curves developed correlated closely to the actual data collected from various petrochemical projects. It is important to highlight that although these researches were fundamental improvements in project and construction management, they are mostly concerned about dealing with a problem which has already taken place and how to correct the problem.

However a current updated concept of project control undertaken by Nikander & Eloranta (2001) utilizes early warnings, this was the first utilization of early warnings in the project environment. The study involved a survey which identifies early warning project signals (which may be an indication of future problems) and relate the signals to project problems and their causes and developed a preliminary model for the utilization of early warnings. The study confirmed the presence of early warning signals in the project environment. It is from the study of Nikander & Eloranta (2001) that this research is based on, where the research is to further converge from the broad scope of project control to a more specific problem of cost control in construction.

## **2.4 Cost Overruns**

Cost overruns or over budget costs can be defined as the excess expenditure from the planned budget spent on the itemised activities of a project. As cost overruns

necessitated an additional allocation of funds in the budget, can it be eliminated? According to Avots (1983), the simplest definition of cost overrun is when the final cost of the project exceeds the original estimate or the budget, but since the original estimate is often based on imprecise information and becomes more accurate only as the project is defined in greater detail as it progresses, extra care must be emphasised when selecting the estimate (subsequently the budget) against which actual construction costs are to be compared. Apart from inaccurate cost estimates, the difficulty of defining cost overruns is may also due to the inaccuracy of the final costs due to problems of collecting actual cost data and claims. Avots (1983) also stressed that a major problem in this situation is the difficulty to tell when all claims have been settled, and when all costs can be considered final.

Cost overruns and delays are not necessarily cause and effect elements which are common in any project environment, thus delays in project schedule do not always cause cost increases (Avots, 1983). The schedule delay effect is indirect and there are many direct factors that contribute to cost overruns. Cost overrun is a common phenomena and a major setback in any project environment or situation, its early detection will therefore be vital for elimination, or minimisation.

Certain cost overruns should never have occurred and can be prevented while some inevitably happened and nothing can be done about it. The former category of cost overruns certainly does not warrant the contractor for claims from the client. Cost overruns that resulted as a result of the client's change order such as design changes,

falls into the category of cost overruns that are non-preventable which put the client liable for payment claims from the contractor. Some contractors, however, disagree the use of the term “cost overrun” in this case, and would prefer to use the term “extra costs” due to client’s variation orders. Another category of non-preventable cost overrun will be due to the contractor’s mistakes and errors, where losses in a particular work area or situation are permanent and cannot be minimised from the activities in that work area / situation. Nonetheless, profits from others areas of the project or situation can neutralise the effects of the cost overruns, or even profits from the next project if the overrun is not substantial. Avots (1983) confirmed this when the same contractors involved in an earlier North Sea project tendered prices on similar projects which cost more than double (even after the allowance of inflation). This suggested that considerable losses have been incurred in the earlier contracts and subsequent projects have to absorb the losses.

A simple example will be inaccuracy in estimation which yielded a tender which is under priced. Cost overruns that can be prevented are those which solely lie within the contractor’s responsibility such as cost overruns which are due to, for example, material and man hour wastage. It is this category of cost overruns that will need extra precautions by the contractor as it will cause over expenditure and no claims from the client will be possible (Refer to Figure 2.2 on page 21).

Cost overruns (or extra costs) that are a result of client’s change orders as mentioned earlier, will not disfigure the contractor’s profits, in fact it will be an

opportunistic platform for the contractor to generate more profit from the project. However, if the variation works are not being managed and performed properly by the contractor, it cannot be guaranteed to be free from cost overruns..

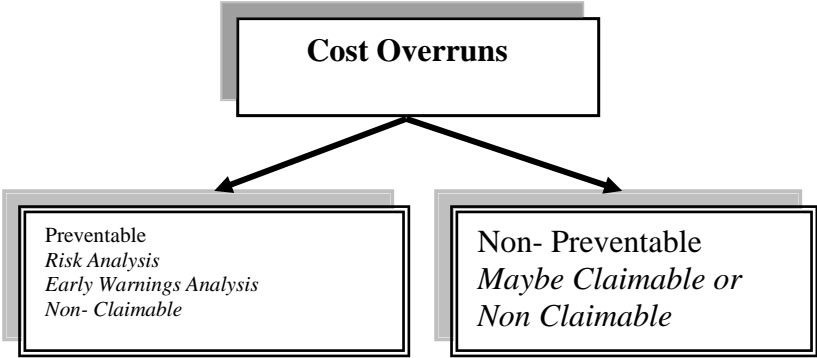


Figure 2.2: Preventable and Non-Preventable Cost Overruns.

Cost overruns can lead to serious problems in construction projects. Cost overruns that occur affect the budgeted profit; the effect can either be negligible or serious. Sometimes cost overruns in one trade of construction can be minimised or eliminated by profit in other trades. There are cost overruns that can be claimed and those non-claimable and also cost overruns that can be avoided and those unavoidable. Those that can be claimed are mainly variation orders by the client and present no problems to the contractor, this usually cannot be avoided as most are instructions by the client who is willing to accept the responsibilities. The cost overruns that can be avoided are the most concerned to the contractor as this will imply negligence on the part of the contractor and no claims will be liable. Although cost overruns (those that cannot be claimed) cannot be totally eliminated, they can certainly be minimised, through careful cost control procedures and strategies and also improved tracking of project expenditures. Cost overruns are late indicators which show that something is

wrong in the current process of construction and immediate actions are called for. For the contractor, the saddest thing that can happen in the company is a situation where the contractor is not even aware that cost overruns are beginning to take shape in his projects. In an examination carried out to review the Florida Department of Transportation's (FDOT) performance in controlling construction cost overruns in transportation projects, cost overruns accounted for 9.5% of the initial budgeted amount and 5.2% were classified as avoidable and 1.4% did not add any value to the projects. The question arises why avoidable cost overruns were not avoided and one of the reasons may be that they have not been detected and the management only knows when the project has been completed.

#### **2.4.1 The Concept of Cost Overruns**

The concept of cost overruns was analysed by Avots (1983). For as long as a project is not completed, the actual amount of cost overruns may vary because the baseline costs may be based on inaccurate and unreliable estimates. Cost overruns can also be hidden inside the budget, for example, when the budget has been overestimated the final cost will include an overrun even if it comes out on budget. For contractors who price their projects too high to avoid any potential cost overrun, conceptually there may be an inherent cost overrun in the project if other contractors are able to construct equivalent facilities at a lower cost. Cost overrun is a terminology of sensitivity to everyone in the construction industry, as no one dares to admit cost overruns in any of their projects as admittance will generally imply incompetence in handling the project. A common and special term used to define discrepancy between original and completed

cost of a project is “cost growth”, which sounds a little easing to the ears and protect those parties involved.

#### **2.4.2 The Cause for Cost Overruns**

To be able to control cost overruns , however, one must first be able to identify their causes and then apply appropriate management techniques to those areas in which such control is most likely to prove beneficial (Avots, 1983). The causes for cost overruns have been investigated by a number of researchers including Avots. Frimpong et. al. (2003) carried out a study on delays and cost overruns for groundwater projects in Ghana, El Choum (2000) listed down parameters that can cause cost overruns, Ogunlana et. al. (1996) made comparisons for situation in Thailand with previous researches, Mansfield et. al. (1994) and Dlakwa et. al. (1990) studied cost overruns and its causes for construction projects in Nigeria and Arditi et. al. (1985) studied the subject and conducted surveys on Turkish contractors and public agencies.

Delay is not necessarily the cause for cost overruns, although it is a common phenomenon in construction management, it is merely a subsequent effect of a more serious underlying cause. Delays can be caused by the contractor’s own mistakes which will most probably give rise to cost overruns, or it can be due to the client’s change orders, or it can also be due to the forces of nature. Whatever the causes for the delays the main objective will be to minimise cost overruns often associated with delays.

Arditi et. al. (1985) explained that the cause for cost overruns can be categorised into four main groups. The main cause was increases in the price of materials as well as workmen's wages due to galloping inflation during the time. This was in agreement with Dlakwa et. al. (1990) who stated that increases in project direct costs head the list of reasons for cost overruns. Reasons beyond government control such as oil crisis, higher inflation rates in industrialized countries from which Turkey imported raw materials and finished products further escalated the problem. Secondly, contractors started to find it increasingly difficult to purchase construction materials at their official announced price due to the clients bound by law, to make monthly payments to the contractors on the basis of the fixed unit price system. Alternatively the variable unit price system which benefited the contractors with the inclusion of all price increase in monthly payments on the other hand caused vast cost overruns to the clients. Thirdly, reasons that led to construction delays can increase cost overruns tremendously such as shortage in resources (qualified manpower, materials and equipments), financial difficulties faced by contractors and public agencies, delays in design work, large quantities of extra work and frequent change orders. Fourthly, incomplete drawings and specifications during the pre-tender estimate resulted in deficiencies in cost estimates leading to underestimation of the contract value, therefore some of the cost overruns may therefore be due to errors in the contract value.

Dlakwa et. al. (1990) however pointed out that time overruns as a cause of cost overruns found least favour with the contractors, but are nevertheless important.