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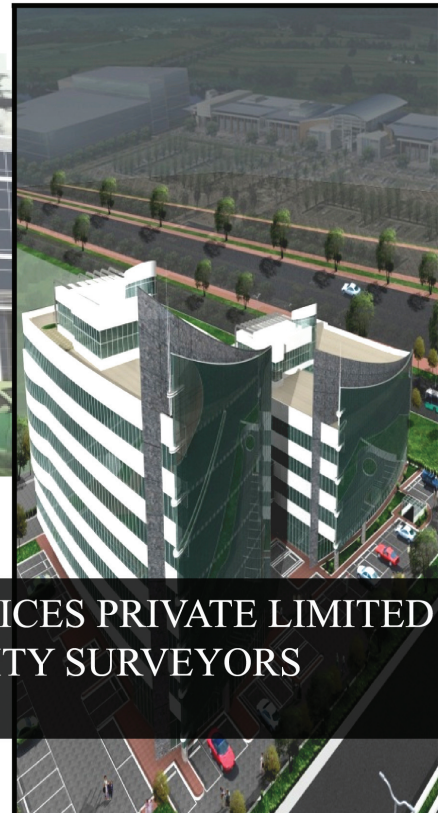
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# SLQS Journal

The Forum of Sri Lankan Quantity Surveyors Across the Globe

Volume 2 – May 2009

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## CONTENTS

Page

### Editorial

- All the Way from Engineer to Courts via Dispute Boards** 5  
Dr. Chandana Jayalath *DSc, MSc, PG Dip, BSc(QS)Hons, MRICS, AAIQS, AIQSSL*
- The Application of Life Cycle Costing to the Construction Industry** 8  
Dhammika Ekanayake *BSc(QS) Hons, CCE*
- Structured Process Improvement For Construction Enterprises (SPICE)** 14  
Professor Dilanthi Amaratunga, *BSc. (Hons.), PhD, FHEA, MRICS*
- Criterion in Choosing a Procurement Method** 18  
D Y J Dewage *BSc(Hons), MRICS*
- Simulated Earned Value Management: An Innovative Monitoring and Forecasting for Project Control (Part two)** 23  
Prabath Hemachandra, *MSc.* and Janaka Ruwanpura, *PhD, PQS (Canada), FIQS (SL)*
- Elementary Claim Preparation and Presentation** 28  
K.G.J.Tennakoon, *MIIE (SL), I.Eng., TechRICS(UK), GCGI(UK)*
- The Risk Management Process** 31  
Sayanthan Ramachandran *BSc.(Hons)QS, AAIQS, MRICS*
- Construction Contract Arbitration** 34  
Renchen Perera
- Quantity Surveyor's Role in Project Management Team** 42  
Shantha Fernando *MRICS, AAIQS*
- Cost Effectiveness and Functionality through Value Management in the Public and Private Sector. – “a need of the hour”** 44  
Professor C. Weddikkara , *BSc(QS)Aust, MSc(bld)Aust, BSc(BE) Colombo , Arch(Aus), ARAIA, AAIQS, FIQS(SL), FIA(SL)*



## Editorial

Dear Sri Lankan Quantity Surveyors

Four months have sped by, leaving us with the second issue of the Sri Lankan Quantity Surveyors Journal on our hands, a most pleasurable event.

We would like to take this opportunity to thank all those of you who were responsible for the overwhelming response of instructive, high-quality articles to our request for matter for this publication. It was a great pleasure to read through these articles, one that we are certain will be echoed by our readers.

On this occasion, we have with us a few articles so extended and yet so densely packed with valuable information that further compression of those articles would have been detrimental to their high quality. We urge you to take particular note of these articles, regardless of their greater length, as they are certainly worthwhile.

Due to the current economic recession we are undergoing, it is clear that more focus is being laid on resolving the many contractual disputes that have arisen as a result of this situation and the resultant problems caused by the interruption to the construction industry across the region. It is a time for further academic introspection with an aim to finding solutions, which could be one of the reasons for the extended articles mentioned earlier – more thought, and hence more pertinent detail, has been put into the work.

We trust that it is essential to remind you that this journal is designed to encourage interest in all matters relating to contract administration, with an emphasis on matters of theory and on-board issues arising from the relationship of contract administration to other disciplines in the construction industry. The subject matter of the articles will consist mainly of, but not be limited to, contractual matters, academic assignments or theses prepared for academic or professional purposes, legal matters, case studies, dispute resolution mechanisms, arbitration, project management, cost management, construction technology and information technology associated with the construction industry. All of the topics mentioned above are of value within the field of construction. However, it is not the purpose of this journal to concentrate solely on drily academia-oriented matters.

The topics written upon in this journal are those submitted by your peers and various highly experienced and qualified industry professionals and academics of today. Articles included in this journal, which have been arriving from the very large number of Sri Lankan quantity surveyors living and working across the globe, are those felt to be relevant to our entire readership, either personally or professionally. We welcome contributions from SLQS members across the world.

We eagerly anticipate future articles from you, our readers, for forthcoming journals

**Editorial Committee**



## All the Way from Engineer to Courts via Dispute Boards



**Dr. Chandana Jayalath DSc, MSc, PG Dip, BSc(QS)Hons, MRICS, AAIQS, AIQSSL**

Started with a military career as a Captain of the SL Army, Chandana Jayalath has been a Chartered Quantity Surveyor since the year 2004. In addition to BSc, MSc and DSc, he has earned two post graduate diplomas, one in construction management and the other in international mediation. His experience counts nearly 17 years in Sri Lanka, Dubai, Singapore, Oman, Qatar and UK, with a latest exposure sidelined in claims and disputes. Backed by his interest in publishing so far around 15 articles in various technical magazines, Chandana was the author of the book titled "Post Contract Administration" that was published in Oman in the year 2005. His book on Claims and Disputes is underway.

Disputes have long been referred to the engineer, who is in a high-up position in the FIDIC forms of contract in two distinct roles; as the agent in protecting the interests of the employer, and as a valuer in an independent capacity. Because of these contrasting roles in the same project, the contractors have been suspicious of impartiality bearing in mind that the engineer is remunerated by the employer acting under a separate agreement with the employer to which the contractor is not a party. Later, FIDIC would have decided therefore that the role of engineer acting in an independent role should be revisited. When the engineer's decision has not been accepted by either of the parties to a contract, the subsequent procedures have been usually addressed under 'settlement' clause. In place of the engineer, it was intended that generally pre-arbitral decisions on disputes would be made by an independent board of construction experts, known as Dispute Adjudication Board (DAB) or Dispute Review Board (DRB). As such, it was hoped that DBs avoid problems associated with the involvement of engineer traditionally in the settlement process.

As a result of prior knowledge gained by regular site visits, Dispute Boards (DBs) are able to deal with disputes quickly as they arise. Generally DBs act within time restraints. However, in most cases this is offset by the advantage of a decision being provided speedily. In complex claims, the DB may interpret the issues, decide matters on principle and refer back to the parties to establish quantum. Although either of the parties may reject the decision of the DB and proceed to arbitration, the arbitrators are unlikely to overturn the DB's findings in some cases. A further advantage is that the DB prevents disputes build-up, by continuous follow-up and intervention as soon as disagreements occur. Unlike arbitration, DBs are not generally taken within the confines of arbitration acts or subsidiary legislations. Instead, they closely resemble expert inputs and accepted norms of the building trade, particularly when the contract is in silence or dilemma. The DB can, with the agreement of the parties, be asked to give an advisory opinion also. This would be similar

in nature to a judgment on a preliminary point in arbitration. The advisory opinion can be used when the parties need guidance on a technical matter that is preventing a further dispute. Further hearings on the dispute may be unnecessary when the interpretative matter is referred to the DB. When a dispute does arise, it is given early attention and addressed immediately. This avoids the commonly encountered situation of the engineer as well as arbitrator being too busy to address a voluminous claim. But it would be difficult to say that all these things never happened. Because of the familiarity with the project, facts are better understood by everyone, perhaps a must when administering the dispute. This is important when in most projects, the same staff rarely remains till completion, that deprives the arbitrator the benefit of their first-hand know-how of events. With such individuals present, greater certainty prevails and the materials relevant to the issue can be easily dug out.

However, DBs are not perfect in all respects when compared with arbitration. Firstly, as more and more DBs are appointed under each contract package, for instance, there could be interface issues that waste goodwill, time and money and moreover the possibility of having contrasting decisions.

Secondly, the dispute board members have to be selected at a time (in permanent boards) when it is not clear what kind of disputes will arise and what kind of expertise will be required to resolve them. This especially applies to the selection of members with an engineering background. If the dispute board is a permanent one and set up before any dispute has arisen, later on with disputes on technical issues for which the engineers on the dispute board are not really qualified and have their expertise in other fields, problems may arise. Since the aim of the DB is to provide a mechanism to ensure a speedy method of dispute resolution, both fair and cheap, all parties involved must ensure that DB procedures do not become over complicated, as otherwise over time the DB route could suffer the same fate as arbitration.

It is clearly preferable for the DB to give unanimous decisions. Whilst provisions may allow the DB to give majority decisions with minority opinions, this would be unsatisfactory. If differing views are held by the members, these can often be incorporated within the decision without adversely affecting the final outcome. Unanimous decisions engender confidence in the dispute process and are more likely to result in a settlement. Under some DB provisions, arbitration is only permitted in the event of a non-unanimous DB decision. An agreement may state categorically that the decision of the DB shall be treated as an expert determination and is final. However, a question arises as to whether the decision of the DB can be enforced contractually. It is likely that the courts will enforce the DB decision pending arbitration unless the court is convinced that the arbitration can commence immediately. If there is no such express provision in the contract that the DB decision will be binding in the interim, even if a reference to arbitration has been served, it will be hopeless.

Many disputes concern 'non-absolute' matters and, in such cases, the DB can devise solutions to avoid 'win-lose' situations. Working relationships are less injured and site-level partnering can continue. Even if the DB decision is contractually 'non-binding' it does not appear to impair the efficacy of the decision. There are two main reasons for this; first that if the DB's decision is admissible in later proceedings the parties know that an arbitrator will be greatly influenced by a decision (on the facts) given by a panel of experts. Secondly, there are swings and roundabouts. It is unlikely that over the course of a large project the DB will always find in favour of the same party. As such, it does not harm when facts are disclosed to arbitration. It will perhaps reduce time and money by avoiding repeating historical background of the case. This is why an arbitral tribunal should be allowed to know the extent of the work of such a body.

Disputants choose arbitration because it saves time and money and is more informal than a court hearing. However, more aptly termed, engineer's intervention in settlement of a difference is a process in which the parties retain the right to decide the outcome of their dispute, rather than an imposed award of an arbitrator. The disputing parties may yield the benefits such as saving of time and money, better relationships, less job disruption, participation of all parties to control the outcome, which may be different or better to that of arbitration, repute of disputes confined within the parties, etc.

The engineer can be called as a witness to give evidence before the arbitrator. No decision or ruling given by the engineer shall disqualify him from being called as a witness and giving evidence in arbitration. No party is relieved from any contractual obligation by the reason of arbitration being conducted during progress, meaning that the obligations of the parties shall not be altered by reason of the arbitration.

Negotiations are said to be 'without prejudice', when nothing that is said or done is normally admissible in evidence in any subsequent trial should the negotiations fail. The objective is to encourage parties to make genuine attempts to settle disputes, without fear of their discussions - and in particular their potential concessions - being subsequently disclosed in court. This is encouraged one way with an express requirement of what we call a 'keep working provision' for the parties to continue to perform their obligations under the contract despite the existence of a dispute.

However, no dispute may ordinarily go to arbitration unless it has run the gauntlet, as laid down in Clause 20 (FIDIC Red Book 1999). Where notice of dissatisfaction has been given under clause 20.4, both parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both parties agree otherwise, arbitration may be commenced on or after the fifty-sixth day after the day on which notice of dissatisfaction was given, even if no attempt at amicable settlement has been made. 'Amicable settlement' referred in this instance is different from various casual settlements, perhaps on daily basis.

When a dispute is referred to the DAB under the Clause 20, it gives a decision on that dispute and, thereafter, if a party is dissatisfied with that decision, it gives a notice of dissatisfaction to the same dispute. Whatever other disputes there may be between parties, none may be arbitrated unless it has gone through the process. Accordingly, if the arbitrators embark on any other matters, without the parties' consent, they will be exceeding their jurisdiction and, hence, their award may be set aside. If the DAB has to decide whether there had been a variation and also its claim for an extension of time which is itself based on the notional delay had there not been acceleration (but not any other of claims as it reasons that their quantification will depend on the extension of time ultimately granted), a question arises whether all claims can be taken up at arbitration. This is because, quantification is followed by entitlement on one hand and each dispute must have passed through the six-step procedure in Clause 20, on

1. Volker Mahnken, Why international dispute settlement institutions should offer ad hoc dispute board rules

2. Pierre Michel Genton, Prevention and Resolution of Disputes, The Growing Interest in Dispute Boards (DB) PMG, Ingénieurs –Economistes –Conseils

the other hand. The fact, for example, that the parties are already in arbitration with respect to certain disputes will not relieve the claimant (or respondent) from having to refer through this six-step procedure in any other dispute.

FIDIC does not encourage parties to go to courts. Courts sometimes return disputants back home once it does not find the way to settlement. Courts resolve disputes via a binding process by applying legal and equitable principles to findings of fact. The Court system is governed by quite strict rules of pleading and of evidence. This system is generally backward-looking in the sense that the outcome depends upon discovering the truth about something that occurred in the past. Subject to rigid procedural and evidentiary rules, the Courts provide legal answers to questions of entitlements and of rights. The Court's focus on deciding questions of fact and law often leaves other interests, options, and solutions unexplored. Hence, the needs that are satisfied by the Court 'model' are not necessarily the needs of the parties. The Courts 'resolve' but they do not 'solve'. Courts' duty is

to find who is right and wrong under prevailing legal conditions. Hence, the Court system has not been responsive to the needs of the disputants for a solution, and not a resolution. Its job is not to maximize the ends of the private parties, but to spell out and interpret what the law says in relation to the disputed issues. However, the trend in UK is to blend this two flavours, court and ADR, not as a mechanism but as an approach in judging justice.

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*Also be noted this discussion is more oriented in a FIDIC based contract modality. Since the contents are author's opinions except where reference given, they are not to be taken as interpretation in a given issue.*

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3. Christopher R Seppala, The Arbitration Clause in the New FIDIC Contracts, International Construction Contracts and the Resolution of Disputes, co-hosted by ICC and FIDIC, July, 2006

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## *Moresk Cleaners Ltd Vs. Hicks [1966]*

*An architect was engaged to design an extension to a laundry. He invited a contractor to design and build the reinforced concrete structure. After erection, the structure became defective because of the negligent design. The architect maintained that he was entitled to delegate certain specialist design tasks and that he was acting as the employer's agent in asking the contractor to design the structure. It was held that if a building owner entrusts the design of a building to an architect, he is entitled to look to that architect to see that the building is properly designed. If the architect was not able to design the work himself he could:*

- 1. tell the client that the work was not in his field;*
- 2. ask the client to employ a specialist;*
- 3. retain responsibility but pay the specialist out of his own pocket – then if the advice proves faulty the person giving him the advice will owe the same duty to him as he owes to the client.*



# The Application of Life Cycle Costing to the Construction Industry



## Dhammika Ekanayake BSc(QS) Hons, CCE

Is a Quantity Surveyor graduated from University of Moratuwa Sri Lanka in 2004 with a BSc (QS) Hons. Also a Certified Cost Engineer (CCE) in AACE International USA, Probationer member of AIQS, Graduate member of RICS, and Graduate member of IQSSL. He is currently working as a Senior Quantity Surveyor for Thermo LLC, Dubai in Dubai International Airport Expansion Project

### Abstract:

This paper discusses the application of **Life Cycle Costing (LCC)** to the construction industry as a tool to compare the alternative construction projects in a logical way. It begins with an introduction to the Life Cycle Costing followed by an explanation of LCC. Furthermore, it explores the common problems of the applications of LCC to the industry in general. This paper presents a state of the art analysis in the area of LCC for construction. It offers a structured overview of theoretical economic methods for LCC analysis and their inherent restrictions. The paper also reviews the primary data which is required to execute an LCC analysis and discusses the limitations in the application of LCC from the Client's perspective. The construction of an office block with two different alternative construction methods was taken into consideration to illustrate the procedure. Both of the options were analyzed by using the most widely used economic analysis tool "Net Present Values" (NPV) and the results were tested against the cost variables such as inflation rate, interest rate, etc. The paper will also discuss the limitations of LCC applications to the Construction Industry. This paper ends with a conclusion that shows that LCC is most effective as a costing method in the early stages of construction.

### Introduction

LCCs are the summation of cost estimates from the inception of a construction project to the disposal of both equipment and the construction, as determined by an analytical study and an estimate of total costs forecast in annual time increments during the project life, with due consideration for time, value and money. The objective of LCC is to select the most cost effective approach from a series of alternative solutions, and achieve the most efficient long term cost of ownership.

The construction clients are seeking high quality buildings, lower costs and shorter lead-times from inception to completion. Buildings represent a large and ongoing investment in financial terms. Improvements in the lifetime quality and cost effectiveness of buildings are consequently

of common interest to the owner, the user and society in general.

Life Cycle Costs for buildings are an important tool for involving the construction clients within the early stage design decisions. However, regardless of its importance, Life Cycle Costing has found limited application so far [Bakis, N., Kagioglou, M., Aouad, G., Amaratunga, D., Kishk, M. & Al-Hajj, A. (2003)]

This paper presents a state of the art review in the area of LCC in construction. The aim is to describe the technique of the main theoretical economic evaluation methods for LCC calculation, and show what relevant data and main sources of data are needed. Furthermore, the limited application of Life Cycle Costing in the construction sector from the clients' perspective is discussed. First, the varying definitions for LCC are discussed. Then a brief description of the selected project is included followed by a discussion of the general criteria for evaluation of LCC. The application of LCC techniques to the selected project is illustrated next, together with evaluation methods for the selected project. Sensitivity analysis has also been used to test the selections against the variables, and finally the last section refers to the limitations of the application of LCC in construction industry today.

### Definition of LCC

The terminology has changed over the years from "cost in use" to "Life Cycle Costing" and latest to "whole life costing" (Flanagan and Jewell, 2005).

The Norwegian Standard 3454 defined LCC as including both original costs and cost incurred throughout the whole functional lifetime including demolition (NS, 2000). There are several other definitions as well, but almost all these definitions are similar in their nature. LCC analysis is, in this context, to be understood as an analysis over the whole life cycle of a building.

## Project description

A Client had to decide whether he should choose the refurbishment of an existing office building or to erect a new building. It is therefore wise to analyze the total Life Cycle Costs of the two available alternatives before his choice is made. LCC analyses for these two different alternatives have been illustrated in the next section. The unit of currency used for the example is Sri Lankan Rupees as relevant to context.

## Evaluation of LCC methods

The literature available for economic costs of buildings shows a broad variation of economic evaluation methods for LCC analysis. They all have their own advantages and disadvantages. The methods have been developed over time for different purposes and the user should be aware of their limitations. The literature shows that the most suitable approach for LCC in the Construction Industry is the net present value (NPV) method due to lesser number of disadvantages compared to the other methods. The model from the American Society for Testing Materials (eqn. 1) for example, distinguishes between energy and other running costs, which is useful in adopting different discount rates for different cost items during the lifetime of the building.

$$NPV = C + R - S + A + M + E \dots (1)$$

C = investment costs

R = replacement costs

S = the resale value at the end of study period

A = annually recurring operating, maintenance and repair costs (except energy costs)

M = non-annually recurring operating, maintenance and repair cost (except energy costs)

E = energy costs

## Application of Life Cycle Cost Analysis

In this particular project, the client has two available alternatives. The first option is to go for an extension to an existing office block with some modernization and refurbishment (Scheme 1). The second available option is to construct a new building following demolition of the existing office block (Scheme 2). Analyses of Life Cycle Costs for the two alternatives are illustrated in this section.

## Assumptions

- (1) Life time of the office building in scheme 1 & 2 are 35 years and 50 years respectively.
- (2) Market rate of Interest is 18% ( $r = 18\%$ )
- (3) Inflation rate is 9% ( $g = 9\%$ )

$$\begin{aligned} (4) \text{ Real rate of interest } i &= (1+r) - 1 \\ &= (1+g) \\ &= (1+0.18) - 1 \\ &= (1+0.09) \\ &= 0.0825 \\ &= 8.25\% \end{aligned}$$

## Calculations of Discounting Factor Scheme 1

- (1) **Proposed extension**  
This is an initial cost there is no interest on that.  
Therefore discounting rate is 1.
- (2) **Professional fees for the extension**  
This also an initial cost. Discounting rate is 1
- (3) **Repairs and modifications**  
It is an initial cost. Discounting rate is 1
- (4) **Major repairs every 15 years**  
 $1 / (1+0.0825)^{15} + 1 / (1+0.0825)^{30}$   
 $0.3045 + 0.0927 = 0.3972$   
Discounting rate 0.3972
- (5) **General maintenance per annum**  
 $1 - [1 / (1+0.0825)^{35}]$   
0.0825  
11.3651  
Discounting rate 11.3651
- (6) **Redecoration every 8 years**  
 $1 / (1+0.0825)^8 + 1 / (1+0.0825)^{16} +$   
 $1 / (1+0.0825)^{24} + 1 / (1+0.0825)^{32}$   
 $= 0.5303 + 0.2813 + 0.1492 + 0.0791$   
 $= 1.0399$   
Discounting rate 1.0399
- (7) **Cooling per annum**  
 $1 - [1 / (1+0.0825)^{35}]$   
0.0825  
11.3651  
Discounting rate 11.3651
- (8) **Lighting and cleaning per annum**  
 $1 - [1 / (1+0.0825)^{35}]$   
0.0825  
11.3651  
Discounting rate 11.3651
- (9) **Insurance per annum**  
 $1 - [1 / (1+0.0825)^{35}]$   
0.0825  
11.3651  
Discounting rate 11.3651

- (10) **Associated annual cost**  
 $1 - [1 / (1 + 0.0825)^{35}]$   
0.0825  
11.3651  
Discounting rate 11.3651
- (6) **Cooling per annum**  
 $1 - [1 / (1 + 0.0825)^{50}]$   
0.0825  
11.8910  
Discounting rate 11.8910
- Scheme 2**
- (1) **Demolition less sale of re-usable materials**  
This is an initial cost without an interest on the cost.  
Therefore discounting rate is 1.
- (2) **Building cost**  
This is also an initial cost. Discounting rate is 1
- (3) **Professional fees**  
It is an initial cost. Discounting rate is 1
- (4) **General maintenance per annum**  
 $1 - [1 / (1 + 0.0825)^{50}]$   
0.0825  
11.8910  
Discounting rate 11.8910
- (5) **Redecoration every 10 years**  
 $1 / (1 + 0.0825)^{10} + 1 / (1 + 0.0825)^{20} +$   
 $1 / (1 + 0.0825)^{30} + 1 / (1 + 0.0825)^{40}$   
 $0.4526 + 0.2049 + 0.0927 + 0.0420$   
= 0.7922  
Discounting rate 0.7922
- (7) **Lighting and cleaning per annum**  
 $1 - [1 / (1 + 0.0825)^{50}]$   
0.0825  
11.8910  
Discounting rate 11.8910
- (8) **Insurance per annum**  
 $1 - [1 / (1 + 0.0825)^{50}]$   
0.0825  
11.8910  
Discounting rate 11.8910
- (9) **Associated annual cost**  
 $1 - [1 / (1 + 0.0825)^{50}]$   
0.0825  
11.8910  
Discounting rate 11.8910

## Project:- New office Block (scheme 1)

Costs	Estimated Target Costs	Discounting Factor	Present Value
	SL Rs.	8.25%	SL Rs.
1. Proposed extension	150,000,000.00	1	150,000,000.00
2. Professional fee for extension	10,000,000.00	1	10,000,000.00
3. Repair and modifications	70,000,000.00	1	70,000,000.00
4. Major repairs every 15 years	18,000,000.00	0.3972	7,149,600.00
5. General Maintenance per annum	1,000,000.00	11.3651	11,365,100.00
6. Redecoration every 8 years	15,000,000.00	1.0399	15,598,500.00
7. Cooling per annum	2,200,000.00	11.3651	25,003,220.00
8. Lighting and cleaning per annum	1,400,000.00	11.3651	15,911,140.00
9. Insurance per annum	750,000.00	11.3651	8,523,825.00
10. Associated annual costs	900,000.00	11.3651	10,228,590.00
(Administrative, Security, Staffing etc.)			
<b>Total Present Value of life cycle costs</b>		<b>(SL Rs.)</b>	<b>323,779,975.00</b>

**Table 1: NPV for New Office Block (Scheme 1- extension to office block with some modernization and refurbishment)**

## Project:- New office Block (scheme 2)

Costs	Estimated Target Costs	Discounting Factor	Present Value
	SL Rs.	8.25%	SL Rs.
1. Demolition less sale of re-usable materials	450,000.00	1	450,000.00
2. Building cost	380,000,000.00	1	380,000,000.00
3. Professional Fees	25,000,000.00	1	25,000,000.00
4. General Maintenance per annum	800,000.00	11.8910	9,512,800.00
5. Redecoration every 10 years	12,000,000.00	0.7922	9,506,400.00
6. Cooling per annum	1,250,000.00	1.0399	14,863,750.00
7. Lighting and cleaning per annum	950,000.00	11.8910	11,296,450.00
8. Insurance per annum	900,000.00	11.8910	10,701,900.00
9. Associated annual costs (Administrative, Security, Staffing etc.)	750,000.00	11.8910	8,918,250.00
<b>Total Present Value of life cycle costs</b>		<b>(SL Rs.)</b>	<b>470,249,550.00</b>

**Table 2: NPV for New Office Block (Scheme 2-** construct a new building following demolition of the existing office block)

## Summary of two alternatives

Costs	Scheme 1 (Refurb.)	Scheme 2 (New Building)
Net Present Value of Life Cycle Costs	323,779,975.00	470,249,550.00
Capital Cost	269,250,000.00	422,100,000.00
Project Life	35 Years	50 Years
4YP For 8.25%	11.3651	11.8910
<b>Annual Equivalent value of Life Cycle Costs</b>	<b>28,488,968.42</b>	<b>39,546,678.16</b>

**Table 3: Annual Equivalent Value of Life Cycle Costs**

## Evaluation of two options

Both of the options are functionally comparable. In addition to that, scheme 2 is for a high quality construction incorporating much Cost-in use to reduce the future expenditure. The high initial costs of cooling and lighting equipment have resulted in savings in the running cost of the equipment. Scheme 1 centers around repairs and modifications and will result in high maintenance and running costs as well as necessitating major modifications throughout the life of the building.

Upon examining Scheme 2, it is not possible to reduce the initial cost, since that may lead to having adverse repercussions on the cost in use, although the intention of this exercise is to keep these to a minimum.

Therefore, on the basis of the data provided the annual equivalent value of Life Cycle Costs, would be as follows: Scheme 1 is the best economic choice. The scheme 2 results are not conclusive on the basis of the data and the annual equivalent value of Life Cycle Costs which was calculated in table 3.

## Sensitivity analysis

During the Life Cycle Cost analysis, a large number of assumptions have to be made. It is necessary to test the sensitivity of these assumptions in order to avoid any possible errors in the overall analysis. Sensitivity analysis will consider all of the relevant information which may influence the final outcome of the solution. The project that is less sensitive in terms of changes in costs, will be the most reliable option

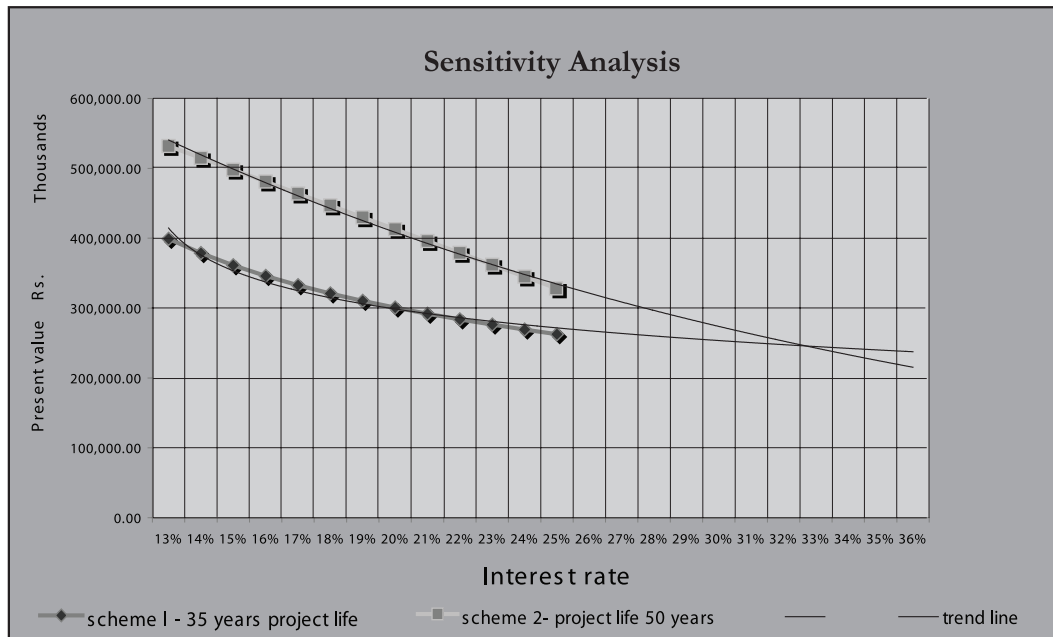


Figure One: Sensitivity Analysis

There are large numbers of assumptions to be made in any costs in use calculation and it is not always possible to assess the effect of changes in these assumptions realistically. One method of testing is to check whether the results achieved by the studies are satisfactory for decision making purposes by repeating the calculation in a methodical way, or changing the value of a single variable each time.

In Figure One above, the calculation has been changed by varying the interest rate with the present value. According to the responding graph when the interest rate is at 33% both of the options can be chosen by assuming inflation as 9%. (With Scheme 1 project life – 35years, Scheme 2 project life – 50 years). According to the graph, with the interest rate at 33% scheme 2 will be the most economical option because it too has a project life of 50 years.

### Limitation of Life Cycle Costing

Life Cycle Costing recognizes that there are confidence and reliability problems associated with initial cost estimating. The fundamental problem associated with the application of LCC in practice is the requirement to be able to forecast the future costs in the long term. In other words the major difficulties facing the application of LCC in practice are related to predicting future events. Some of the key issues can be listed as follows,

- Assessing the project life  
(Physical life of a building/ Economic life of a building/ Functional life of a building/ Technological

obsolescence)

- Inflation
- New technology
- Data problems  
(Accuracy of data/ Interest rate/ Taxation/ Maintenance management)
- Knowledge problems  
(Unfamiliarity with the Design-to-Cost concept/ Unknown relationship existing between Initial Cost and Future Cost/ Client awareness)
- Procedural problems  
(Unreliability of decision taken/ lack of integrity of forecast/ majority of LCC calculations involve uncertainty/ unavailability of qualified staff)
- Management problems
- Cost problems

### Conclusion

The Life Cycle Cost approach in forecasting the future costs of buildings can play a significant role as a decision making tool in the construction industry. In looking at the cost of a building it is far too short-sighted to consider merely the initial acquisition costs. Attention must be paid to the subsequent running costs associated with the operation and maintenance.

The choice of the right calculation method for LCC becomes easy and obvious if the advantages and disadvantages are



appreciated. This paper presented an integrated environment, which aims to assist the application of Life Cycle Costing by providing a framework and a mechanism for recording the LCC data and a number of tools for assisting and simplifying the application of the technique. The main characteristic of the environment is that it provides a holistic approach to Life Cycle Costing by integrating the collection of the data and the design and management of buildings within a single framework. An additional characteristic is that it does not impose any particular structure to the LCC data but rather it allows the user to specify the structure according to his/her needs. The development of the system gave rise to two important issues. The first concerns the interrelations between the different building elements and the way those interrelations could be handled. The second concerns the importance of the actual LCC data of a building in predicting the future costs of that building.

Reliability of the selected option will remain unsure even after we get the results. To overcome such problems sensitivity analysis will be an effective solution. Here, variable components such as interest rates are tested against the present value of the building to derive the most reliable decision. There will be a point where the options will give the same Net Present Value against one specific interest rate.

The system presented here addresses some of the practical problems in the application of Life Cycle Costing in the Construction Industry. If LCC is adopted as a decision making tool, the lifetime quality and the cost effectiveness of buildings would improve by using LCC at the early design stage.

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# Structured Process Improvement For Construction Enterprises (SPICE)



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Professor Dilanthi Amaratunga currently is a Professor at the School of the Built Environment at the University of Salford, UK. She completed her BSc in Quantity Surveying Degree with a First Class Honours at the University of Moratuwa in December 1993. She was the first of the cohort in all four years of academic studies and also was the recipient of the awards for the best student and best results at the final year of studies. She was a lecturer at the Department of Building Economics, University of Moratuwa from 1994 to 1997 prior to the commencement of her PhD at the UK's highest rated Research Institute at the University of Salford, which she completed in 2000. Since then, she has performed the roles of Programme Director of Quantity Surveying, Senior Lecturer and Director of Postgraduate research studies at the University of Salford. She was promoted to a full academic professor in 2007, the first Moratuwa University Quantity Surveying Graduate to receive such an honour.

## **ABSTRACT**

Recent construction industry reports have emphasised the call for the construction industry to increase productivity and improve quality and in particular urged the industry to focus on improving the construction processes. However, the industry has no recognised methodology or framework on which to base a process improvement initiative. The absence of guidelines has meant that any improvements are isolated and benefits cannot be co-ordinated or repeated. The industry is unable to systematically assess construction process, prioritise process improvements, and direct resources appropriately. Moreover, it is not possible for companies to benchmark and measure their performance relative to other organisations. SPICE (Structured Process Improvement for Construction Enterprises) has attempted to address these issues. SPICE is an initiative that develops an evolutionary step-wise process improvement framework for the construction industry. The research on SPICE has drawn specifically on the Capability Maturity Model (CMM), which has been used successfully in the IT sector and has delivered significant productivity improvements. This short article provides an overview of the SPICE concepts and its applications in construction enterprises. In particular it presents the results of: (i) a pilot assessment of a small architectural firm; (ii) the case study of a £6M leisure complex; and (iii) the case study of a £55M hospital. The article concludes with a discussion on the benefits of using SPICE.

## **INTRODUCTION**

The construction industry has been under increasing pressure recently to increase productivity and deliver a service of consistent quality. The targets set by Sir Michael Latham in 'Constructing the Team' [1] however, have yet to be achieved. In his report of July 1998, Sir John Egan [2] emphasised the call for productivity improvements and

urged the industry to focus in particular on construction processes. Hammer and Champy [3] echo this opinion by suggesting that it is no longer enough for organisations to do traditional tasks better, but rather recommend that the old "individual-based task-oriented" management concept be discarded completely and be replaced with a "team-based process-oriented" management concept. Until now though, the industry has lacked a recognised methodology or framework to improve its processes. Organisations have attempted various improvement initiatives but the absence of guidelines has meant that these efforts are often isolated and benefits cannot be co-ordinated.

SPICE is a concept aiming to develop a structured process improvement framework for construction. Evidence from other sectors [4,5] show that continuous process improvement is based on many small, evolutionary steps, rather than revolutionary measures. The SPICE research draws heavily from the concepts of the Capability Maturity Model (CMM) [5,6]. This framework was developed by Carnegie Mellon University for the US Department of Defense to provide them with a means of assessing their software suppliers. However, not only was it a successful benchmarking tool, suppliers implementing the framework found that it delivered significant business benefits. For example, Hughes Aircraft (USA) reported a 5:1 ROI, and Raytheon (USA) achieved a 7.7:1 ROI and 2:1 productivity gains [6]. Industry analysis by J. Herbsleb [7] showed that companies implementing CMM achieved an average of 35% productivity improvements and an average of 39% post delivery defect reduction. The SPICE project aims to tailor the original CMM framework into a construction specific maturity model. The SPICE framework is composed of two elements: the model itself and an assessment mechanism by which an organisation is assessed against the model.

## THE SPICE PROCESS IMPROVEMENT FRAMEWORK

The SPICE model is based on five evolutionary steps of process maturity [8]. The framework organises these steps into levels or 'plateaus' that lay successive foundations for the next level. Each level comprises a set of key processes that, when satisfied, stabilise an important part of the construction process. The levels define a scale by which the maturity and capability of a construction organisations processes can be measured. By establishing their position on the scale, priority areas for process improvement efforts can be identified. The model states that little value is added to the organisation by addressing issues at a higher level if all the key processes at the current level have not been satisfied.

In general terms, the levels can be characterised and distinguished as:

- **Level 1, Initial-** The processes are characterised as ad hoc, and occasionally even chaotic. Few processes are defined, and success depends on isolated effort.
- **Level 2, Repeatable-** Basic project management processes are established and repeatable. The necessary process discipline is in place to repeat successes on previous projects. This level has been the major focus of research to date.
- **Level 3, Defined-** The processes for all activities are documented, standardised, and integrated into the organisation. All projects use an approved, tailored version of the organisation's standard process.
- **Level 4, Managed-** Detailed measures of the processes and product quality are collected. Both the processes and products are quantitatively understood and controlled.
- **Level 5, Optimising-** Continuous process improvement is enabled by using feedback from the processes to pilot innovative ideas and technologies.

Each SPICE level has a number of key processes. These are the processes, which must be implemented, to achieve the process capability [9] of a certain level. The Key Process Areas for Level 2 are as follows: brief/ scope of work management; project planning; project tracking and monitoring; sub-contract management; project change management; risk management; and project team co-ordination.

## THE SPICE ASSESSMENT MECHANISM

The SPICE assessment procedure assesses an organisation's processes against five 'Process Enablers' defined by the framework. Each enabling feature must be satisfied for a process to be considered mature. They are common across all the key processes and classify features that a key process must

posses in order to yield successful results. These enablers are itemised below:

- **Commitment** - This criterion ensures that the organisation takes action to ensure that the process is established and will endure. It typically involves establishing organisation policies. Some processes require organisational sponsors or leaders.
- **Ability** - This describes the preconditions that must exist to implement the process competently. It normally involves adequate resourcing, appropriate organisational structure, and training.
- **Verification** - This verifies that the activities are performed in compliance with the process that has been established. It emphasises the need for independent verification by management and quality assurance.
- **Evaluation** - This describes the basic internal process evaluation and reviews that are necessary. These internal evaluations are used to control and improve the processes. During the early stages of maturity, this translates into efforts by the team to improve their existing processes.
- **Activities** - This describes the activities, roles and procedures necessary to implement processes. It typically involves establishing plans and procedures, performing the work, tracking it, and taking corrective action as necessary.

## RESEARCH METHODOLOGY

A review of existing process improvement literature was performed with specific reference to the original CMM. A steering group of 7-8 practitioners and academics would then lead the research by developing theoretical propositions which the core research team would investigate. It is generally acknowledged that there are large gaps between industrial perspectives and requirements, as opposed to the academic outlook [11,12]. The SPICE project attempted to address this balance by carrying out the research in close collaboration with several industrial partners and with support from the DETR. Continuous dissemination and exchange of ideas verify findings with industry representatives. The research was presented to a bi-annual 'panel of experts' workshop where 30-40 senior academics and industrialists provide discussion, feedback and future direction. The proposals were also validated by industry questionnaires and during several industry case studies. Sarshar [13] discusses the methodology in more detail.

The research team used a series of case studies in order to validate the research in an industrial context. During these case studies, several data collection techniques were used. Initially, a questionnaire based on the original CMM

questionnaire, was issued to establish whether the subject area was felt relevant to the construction industry [10]. This was followed by a pilot assessment exercise to ensure that the assessment techniques and tools were suitable [10]. Most recently, two case studies have been performed in order to firstly, test the framework in a 'live' construction project environment, and secondly, to establish whether the results derived are meaningful. The findings of these case studies were generalised to theoretical propositions.

## Pilot Assessment of a Small Architectural Firm

The purpose of the pilot assessment was to test the suitability of the SPICE assessment mechanisms in a construction environment and attempt to identify the similarities / differences with the software sector. It was also the intention to establish whether the results derived would be meaningful. The findings of the assessment are summarised as follows:

- Construction participants generally understood the issues addressed in the CMM questionnaire.
- The assessors (from the IT industry) could relate to, and interpret the pattern of the responses (in a construction company). The responses reflected some organisational characteristics, which are also encountered in software development organisations.
- Organisation culture and communications issues in construction are similar to those encountered in software development organisations.
- Process capability characteristics are broadly similar to that in the software industry.
- Systematic quality management, change management and other project control mechanisms would have similar benefits in the construction industry, to those anticipated in the software industry.

Some of the differences between the construction and software development industries, which were noted by the IT management consultants were that in construction, professional qualifications, customs and working practices are better established, and in construction industry, standards and data are more readily available.

## Case Studies

The above pilot study was followed by several case studies on live construction projects. The objectives of these case studies were to: (i) identify any process issues not addressed by the framework; (ii) determine if the recommendations derived are meaningful; (iii) capture the experiences of the project team; and (iv) test the effectiveness of the assessment mechanism

## Case Study 1

Case study one was a £6 million design and build fit-out project late in its construction phase. 12 members of the project team were involved in the assessment across disciplines and from senior management to site operatives. The assessment found that the project management processes such as project planning, project tracking and monitoring and sub-contract management were in place and generally well managed. However, virtually no evaluation of project processes was made and many of the design control procedures were weak or not in place. "Risk Management" and "Project Team Co-ordination" were not adequately implemented. The assessment also identified cultural issues not specific to the model. The team as a whole had an open culture but project goals were not communicated throughout the team. Good work and project successes were not recognised or rewarded. A workshop was held to review the findings of the assessment and to develop improvement recommendations. The organisation will take these proposals forward and the research team will monitor progress. The results were formulated in matrix similar to the depicted matrix. The key processes were presented horizontally and the process enablers vertically. The process weaknesses were shaded in the matrix. This matrix was presented to the team.

		Case Study 1					
		Key Process Areas (Level 2)					
		Brief & Scope Mgt.	Project Planning	Project Tracking	Subcontract Mgt.	Project Change Mgt.	Risk Mgt.
		Team Co-ordination					
Process Enablers	Commitment	?					
	Ability	?					
	Activities	?					
	Evaluation	?					
	Verification	?					

## Case Study 2

Case study two was a £55 million Private Finance Initiative design and build project at mid-construction phase. 15 members of the project team were involved in the assessment across disciplines and from senior management to site operatives. The assessment found that general project management processes were well managed. Not only were the processes well planned and documented at the

commencement of the project, there was also evidence that they were practised during the project. The major weakness identified was similar to case study one; the processes were not periodically reviewed, evaluated and improved during the project. A similar matrix to the first case study was developed for this project. A workshop was held to reach an agreement on the findings and to develop improvement proposals. Since the majority of the Key Processes defined by Level 2 were satisfied, the recommendations of the assessors were to be used when the organization is focussing on the Level 3 issues of the model.

## ANALYSIS OF FRAMEWORK - BENEFITS OF USING SPICE

The observed benefits of SPICE can be listed as follows:

- SPICE creates a strong process focus within project teams.
- The framework identifies process strengths as well as weaknesses.
- The assessment time is relatively short. It takes around 3 days on site, whilst only requiring the participation of the whole team for a briefing at the start of the assessment, and for a workshop to discuss the findings and determine improvement priorities.
- Though not part of the framework, the assessment process highlights cultural issues, as well as evaluating process management.
- SPICE creates a strong platform for discussing improvements and capturing implementation plans.

## SUMMARY

This article describes the concepts behind the SPICE project and explains its research methodology. SPICE intends to develop a stepwise process improvement methodology for the construction industry. This will be tailored based on an existing successful model in the software industry, namely the Capability Maturity Model (CMM). The research has conducted a pilot study on a firm of architects and two case studies on construction projects. These were tested against level 2 of the SPICE framework. The case studies have shown that SPICE: (i) creates process focus; (ii) is meaningful to project teams; (iii) is a good process diagnostics tool; (iv) has a short assessment process; and (v) highlights some cultural issues as well as process issues.

The recommendation for improvements to the framework are that: (i) the scope of SPICE needs to be extended so that it is a comprehensive improvement tool; (ii) terminology of the framework needs improvement; (iii) a key process "Health & Safety Management" must be added to level 2;

(iv) the definition of some key processes need clarity.

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## Criterion in Choosing a Procurement Method



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### Procurement Methods

The procedure adopted to procure construction work is regarded as the procurement method of any construction project. The text book "Law and Management in Construction Contracts" by John Murdoch and Will Hughes describes the procurement method of a construction project as follows: *"The characteristic pattern of participant's involvement, and the deposition of risks among them constitute the procurement method or procurement system for a project"*.

Different procurement methods have been developed in the past and extensively used in the construction industry to cater to the specific requirements of construction projects. The well known main procurement methods that have been used in the construction industry are as follows:

- Traditional method.
- Design and Build method.
- Management Contracting method.
- Construction Management method.
- Design and Manage method.

The Partnering method, which is regarded as "open book" approach in procuring construction work, has also been successfully used in the recent past, but its success rate in this part of the world is yet to be established. However, some of the experts in the industry argue that partnering is not a procurement method by its own, but it is a management philosophy that can be successfully used to procure construction work. The writer assumes that the readers are well conversant with the above procurement methods; therefore, they are not elaborated further in this article.

### The Criterion in Selection

The characteristic pattern of participant's involvement and the deposition of risks decide the procurement method that is to be chosen for any construction project. Therefore, the procurement method that caters for the Client's needs and project characteristics is the most suitable procurement

method for any given construction project. It can further be elaborated in theoretical terms as the best-fit procurement solution that is chosen based upon sound judgment giving due consideration to identified and acceptable distribution of risks involved in the construction of any particular construction project.

Some of the factors play a crucial role in deciding the suitability of the procurement method, they are:

- i) Level of the knowledge and involvement of the client with the construction process
- ii) Separation of design from construction management
- iii) Reservation of client's right to alter the works
- iv) Clarity of client's contractual remedies
- v) Complexity of the construction project
- vi) Speed in execution required from inception to completion
- vii) Certainty of price
- viii) Standard of quality
- ix) Transfer or distribution of risks

### Level of the Knowledge and Involvement of the Client with the Construction Process:

Some clients may prefer to be involved on a day-to-day basis, whereas others may let the project team handle the process and pay them when it is satisfactorily completed. Among many points between these two extremes, the decision would depend at least partly on the client's previous experience in the industry and on the responsiveness of the client's organization. If the client is willing to be involved in the process, identification of a knowledgeable person responsible for decision making on behalf of the client is essential for smooth and timely functioning of the process. Therefore, it is important to decide the extent to which the Client wants to be involved in the process, as it would affect the type of procurement method to be chosen. For example, the traditional method demands least from the client as it delegates design/management responsibilities to

the architect/engineer and construction to the contractor. The contract administration in the Design and Build method does not involve in the same manner as the architect/engineer in the Traditional method, therefore Design and Build method demands more involvement from the Client.

Both Management Contracting and Construction Management methods demand an active role from the client in project management process with the project managers. Design and Manage method combines the characteristics of the Design and Build method and Management method, therefore the client needs to play an active role.

### **Separation of Design from Construction Management:**

The design may sometimes be such an intrinsic part of the project that it cannot be separated from the management. However, in many instances the design is not the overriding feature of the project. In the former case, it is not advisable to split management from the traditional purview of the design leader, i.e. the architect or the engineer, as such a distinction may emasculate the architectural/engineering values, but in the latter case where architecture/engineering may not be a very vital aspect, design can be separated from the construction management. The procurement method restricts the flexibility in separating design responsibilities from the construction management. A good example is the Traditional method combining management with design by virtue of the position of the architect/engineer in the process. The architect/engineer, in their capacity as design leader and contract administrator, are in control of most of the major decisions in a project.

However, Design and Build method does not separate design from management as both functions remain within one registration (a single focal point). The difference in Design and Build method from Traditional method is that the design issues in Design and Build method are debated and resolved within the Contractor by weighing against simple cost or time exigencies, which automatically exclude the Client's involvement in such debates. As the Design and Build contracts are let on an agreed lump sum, it will motivate the Design and Build contractors to focus on time and cost parameters over other considerations, hence the possibility of having some compromise on the design cannot be avoided. Both Management Contracting and Construction Management methods are a clear and deliberate separation of design from management. The design leader has a role in coordinating and integrating design work, but Management Contractor/Construction Manager should ensure that the design information is available at the right time and the contractors' design is properly integrated.

### **Reservation of Client's Right to Alter the Work:**

The work may require to be altered due to the following three main reasons:

- The client decides to change what is being built.
- The design team decides to revise or refine the design as necessitated by recently found details.
- Alterations are to be made as a response to external factors.

As the construction contracts impose obligations on the contractor to execute the work in the given time, it gives the right to the contractor to do the work, which cannot lightly be taken away. Therefore, when work needs to be altered, firstly it should be facilitated by the provisions in the contract and secondly the contract should be clear in stating how the value of altered work is to be assessed. However, the procurement method affects the extent to which the contract structure facilitates changes.

An example is that in the Traditional method contracts typically contain detailed clauses defining what would be permitted as variations but there are some restrictions to the real scope of variations that can be instructed. Therefore, despite of having extensive provisions for instructing and valuing variations in Traditional method contracts, their true scope is somewhat limited.

The Design and Build method contracts usually lack the detailed contractual mechanism for instructing and for valuing variations. The Design and Build method is based on a principle that provides a lump sum price for an integrated package, thus it does not favour for variations.

Both Management Contracting and Construction Management methods involve a series of separate packages, thus alterations to the scopes of individual packages can be made quite late in relation to the project's overall start date, but prior to the individual packages being put out to tender. Therefore, both Management Contracting and Construction Management methods provide the maximum flexibility for reasonable late alterations.

### **Clarity of Client's Contractual Remedies:**

The degree to which the client can pursue remedies in the event of dissatisfaction with the process is an important part of the contract structure. Some contract structures are clear and simple in describing whom to be blamed for a default, whereas others are intrinsically more complex, regardless of their text of actual clauses. One of the fundamental aims behind a contract is to enable people to sue each other in the case of non-performance. The clarity in contractual remedies varies with the procurement method.

An example is that the Traditional method provides the least clear contractual remedies, as the contractor is employed to build what the client's design team has documented. In the event of any potential dispute about some aspect of the work, whether it belongs to design or workmanship, it is to be resolved prior to pursuing it. The involvement of nominated sub-contracts makes this task more difficult.

The Design and Build method with its single point responsibility carries the clearest contractual remedies, as the Design and Build contractor will be responsible for all of the works in the project, regardless of the nature of the fault. However, in the event that the Client had done a large amount of preparatory design work prior to the contractor was appointed, clarity of the remedies would be compromised.

The Management Contracting method due to its sub-contract packages provides the worst clarity of contractual remedies and it can be regarded as the extreme end of Traditional method contracts with regard to clarity of contractual remedies.

The Construction Management method with its direct contracts between the Client and the Trade Contractors provides clear lines of responsibility but the involvement of a design team and a variety of separate trade contracts make the situation more complex than Design and Build but not as complex as Traditional Method.

### **Complexity of the Project:**

Complexity cannot be considered in isolation, as it is inextricably bound with speed and with the experience of those involved in the project. The technological complexity can be mitigated by using highly skilled people and organisational complexities can be translated into the number of different organisations needed for the project. Therefore, a project with a necessity of large number of diverse skills is more organisationally complex than a project with fewer requirements of skills. Different procurement methods provide different degrees of flexibility to handle the complexities of the project.

The Traditional method involves an organisation structure that is more complicated for a simple project. In complex projects there will typically be high levels of nomination due to the need of harness of the design skills of specialist trade contractors. When this forms a large proportion of the contract works, Traditional method contracts may break down, as it is based on the assumption that the main contractor will be doing most of the contract work. Therefore, Traditional method is more suitable for projects that are not very complex or very simple.

Due to its single point responsibility, the Design and Build method is more suitable for simple projects as they do not demand expertise of many technical disciplines.

The Management Contracting and Construction Management methods are more suitable for complex projects as they can utilise the expertise, experience and specialist skills of expert sub-contractors or trade contractors, whilst having expert management skills in place. They provide an additional advantage of overlapping the design with the construction process.

### **Speed Required from Inception to Completion**

A single construction project typically constitutes a large proportion of a client's annual expenditure and a large proportion of contractor's annual turnover, which make every individual project very important both to the client and to the contractor. As briefing designing, specifying and construction follow one after the other, the construction is a linear process. Therefore, if these steps can be overlapped, the overall time can be significantly reduced, however, too much overlapping can also slow down the process thereby cancelling intended gains. The flexibility in overlapping of events is dependant upon the procurement method.

The Traditional method is generally regarded as the slowest due to its basic requirement of completing design/specification prior to inviting the tenders. Although some speed can be achieved by having large provisional sums in the BOO (though not recommended) and approximate quantities in lieu of firm quantities, it is not capable of providing fast track construction.

The Design and Build method is much faster than the Traditional method due to the safeness in making early assumptions as the contractor undertakes the design, however, time may initially be required to finalise the contractors' proposals and agree with the client's requirements.

The Management Contracting and Construction Management methods are generally regarded as the best fast-track procurement methods due to the flexibility they provide in sorting out individual sub-contract/work-package at much later date after commencement of the construction that resulted from productive overlapping.

### **Certainty of Price:**

Although, the reliability of initial budgets is highly significant for most clients, it should be generally weighted against the financial benefits of accepting some of the risks, which make the price less certain. It is rather important to look for the option, which provides good value for money in lieu of

selecting the cheapest option. The certainty in price varies in accordance with the procurement method.

In the Traditional method with its wide ranging variables in pricing documents like firm quantities, approximate quantities, schedule of rates, etc. it can cater to a variety of options. However with all these options, the contractors will be paid according to their pre-estimated rates subject to the information made available to him at the time of tendering.

The Design and Build method provides the best certainty of price as it is based on a lump sum price for all the required work. As the contractor may add some contingency money in the price for him to deal with possible unforeseeable at a later date, the Design and Build method may at least in theory result in a high price definitely.

As the Management Contracting and Construction Management methods consist of a series of contracts, which are let as the work proceeds, it is impossible to have confidence on the final price, until all packages of the project are completely awarded.

## Standard of Quality.

The required quality and the control over quality to achieve the required standards generally differ from client to client as well as from project to project. The procurement method has considerable influence over the controlling of quality.

The Traditional method facilitates tight control over the quality standards as the design is to be developed by an architect/engineer, prior to the preparation of tender documents, however, the extra time required for pre-contract phase will delay starting of work on site.

The Design and Build method due to its single point of responsibility, is not generally regarded as a favourable method in achieving good quality control, however, quality should not be a serious problem if properly covered in the contract documents.

The Management Contracting and Construction Management methods are generally regarded as most suitable methods of achieving the required quality as every element of work is supposed to be carried out by a specialist under expert supervision.

## Transfer or Distribution of Risks:

The risks are inevitable and cannot be eliminated, but at a premium, they can be transferred. Dealing with risks falls into the following three stages:

- Identification of risks
- Analyze the risks
- Respond to the risk

Identification of risks should be linked with the client's priorities for the project. i.e. if the timing of the project is critical, the severity of time related risks will increase.

The risks involved in a project are generally as follows:

- Physical Work, i.e., ground conditions, artificial obstruction, defective materials or workmanship, inadequacy of staff, labour, plant, materials, time or finance, etc.
- Delay and Disputes, i.e., possession of site, late supply of information, inefficient execution of work, delay outside both parties' control, etc.
- Direction and Supervision, i.e., greed, incompetence, inefficiency, unreasonableness, partiality, poor communication, erroneous document, defective designs, unclear requirements, changes in requirements, inappropriate consultants/contractors, etc.
- Damage and Injury to Persons and Property, i.e., negligence or breach of warranty, uninsurable matters/risks, accidents, consequential losses, etc.
- External Factors, i.e., government policy on taxes, labour, safety or other laws, planning approvals, financial constraints, energy or pay constraints, cost of war or civil commotion, etc.
- Payment, i.e., delay in certification, payment, and settling claims, legal limits on recovery of interests, insolvency, funding constraints, inflation, etc.
- Law and Arbitration, i.e., delay in resolving disputes, injustice, uncertainty due to lack of records or ambiguity in contracts, cost of obtaining decisions, enforcing decisions, changes in statutes, new interpretation of common law, etc.

It is important to analyse each of the risk in terms of likely frequency of occurrence, severity of impact, and the range of possible values in respect of low, medium and high. As some risks may be critical than the others, analysis will help to raise the awareness with regard to the risk exposure.

Having analyzed the identified risks with regard to the client/project's priorities, it needs to be decided who is best placed to manage the risks. The choices lie between the client, designer/consultants, contractor and insurers. The decision of laying-off risks on to others should involve weighing up the frequency of occurrence against the level of premium being paid to transfer the risk. The procurement method has direct influence over the transferring or retaining of the risks.

The Traditional method retains the following risks with the Client:

- building suitability
- contractor insolvency
- delay by consultant or the causes allowed by the contract

The Design and Build method retains the following risks with the Client:

- building suitability
- design functionality and usability
- design insurance if contractor moves away from this type of business, goes out of business or fails to pay premium

The Management Contracting and Construction Management methods retain the following risks with the Client:

- building suitability
- contractor insolvency
- delay by consultant or the causes allowed by the contract
- cost overrun and time overrun

In summing up, it can be stated that the above criterion provides a basic framework for selecting the most appropriate procurement method but they may not be comprehensive, as there may be other more important factors that apply to a particular client. Furthermore some of the factors may not apply for a particular project requirement. Therefore, before finalising the procurement method, it is important to familiarise with the procurement methods and go through a series of decisions so that the most appropriate procurement method can be identified.

## *Delaware Mansions Limited and others Vs. Lord Mayor and Citizens of the City of Westminster [2002]*

*The landowner claimed damages for works necessary to remediate damage to his land after encroachment of tree roots onto his property. The issue had not been properly settled in English law. The problem was to be resolved by applying a standard of reasonableness as between neighbours. Damage consisting of impairment of the load-bearing qualities of residential land was itself a nuisance. If there is a continuing nuisance of which the defendant knew or ought to have known, reasonable remedial expenditure could be recovered.*

*The judgments in Goldman and the Wagon Mound “... are directed to what a reasonable person in the shoes of the defendant would have done. The label nuisance or negligence is treated as of no real significance. In this field, I think, the concern of the common law lies in working out the fair and just content and incidents of a neighbour’s duty rather than affixing a label and inferring the extent of the duty from it. Even in the field of Rylands v Fletcher (1868) LR 3HL 330 strict liability the House of Lords in [Cambridge Water] has stressed the principles of reasonable user and reasonable foreseeability: see the speech of Lord Goff of Chieveley, at pp 299-301. It was the absence of reasonable foreseeability of harm of the relevant type that excluded liability in that case”.*



# Simulated Earned Value Management: An Innovative Monitoring and Forecasting for Project Control (Part two)

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*(Continuation from the previous volume- January 2009)*

## **Abstract:**

Earned value management (EVM) is one of a widely used control tools in project management. In addition to providing vital information regarding the status of a project in terms of budget and schedule at any given time, it could forecast the ultimate outcome of the project with a set of limited assumptions. However, EVM has limitations when it comes to proactive decision making in handling uncertainties. This paper presents the development of a tool integrating Monte Carlo simulation with EVM method to assist project managers to reduce adverse impacts on projects due to uncertain situations. Simulated Earned Value Management Tool (SEVM), can simulate cost and duration outcome for each activity of a project and has the capacity to incorporate the current progress of all the activities. This simulation tool provides information on a) probability of completion for a given cost and time and b) range estimation on the cost and schedule performance variances and indices at any future date until the project completion, both of which enables the project manager to identify different cost and schedule outcome combinations and timeframes where adverse impacts are more significant.

**Keywords:** Cost, Schedule, Earned Value, Simulation, Stochastic

## **5. SIMULATED TIME-COST DISTRIBUTION**

This section provides the graphical output of the time cost distributions for the entire project. Figure 5 shows the time-cost distribution for a hypothetical project network. The horizontal axis on the chart represents the time while the vertical axis represents the cost. The user can select the data type of the output, the distribution type and also the distribution range. Data type selection determines the

simulation for which the graphs need to be generated. This includes the original simulation which was carried out prior to the project start and the updated simulation which incorporates the current progress details of the project. Thinner lines are used to plot the original simulation graphs while thicker lines are used for the updated simulation. Selection of both data types will generate distributions for both simulations in one graphical output, with one distribution superimposed on the other distribution. This enables thorough comparison between the two simulations (Hemachandra and Ruwanpura, 2008).

Three options are available for the type of distribution to be displayed, which are the Budgeted Cost vs. Time, Actual Cost vs. Actual Time and the Earned Value Distribution. The Budgeted Cost vs. Time graph is a single line graph which provides the relationship between cost and time of the baseline project network plotted as a yellow line on the graph. Actual Cost vs. Time graph is a combination of Actual Cost vs. Time graphs of all the simulation runs. Hence this graph is a distribution that covers a range. For each time period, the graph covers the area from a minimum cost to maximum cost. Maximum and minimum limits are determined based on the distribution range selected, which is plotted in red colour in the chart. Earned value distribution is the combination of Earned Value vs. Time graphs of all the simulation runs. This graph also covers a range similar to the Actual Cost vs. Time graph which is plotted in blue colour. The distribution range section determines the lower limit and the upper limit for each time unit of the distributions that consider all the simulation runs. This parameter does not impact the baseline Cost-Time graph. The four options available for ranges are 0% -100%, 10%-90%, 20%-80% and 30%-100%.

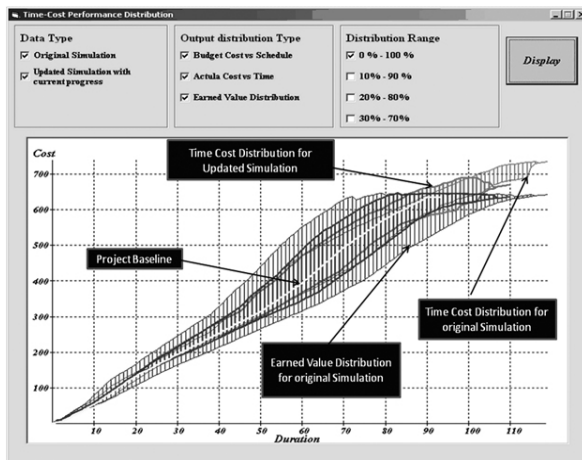


Figure 5: Actual Cost vs. Time Distribution

## 6. PROJECT FINISH TIME-COST PARAMETERS

Time and cost distributions and other parameters relating to the project completion are briefly explained in this section. This information provides a clear understanding about the probability of achieving success in project objectives in terms of both cost and schedule. A scatter plot of project end cost- time combinations for all the simulation runs and cumulative distribution function (CDF) graphs for cost and time at the project completion are generated in this section in a graphical form. The user can obtain statistical information relating to project finish in the form of a list. Figure 5 shows the output screen of this section.

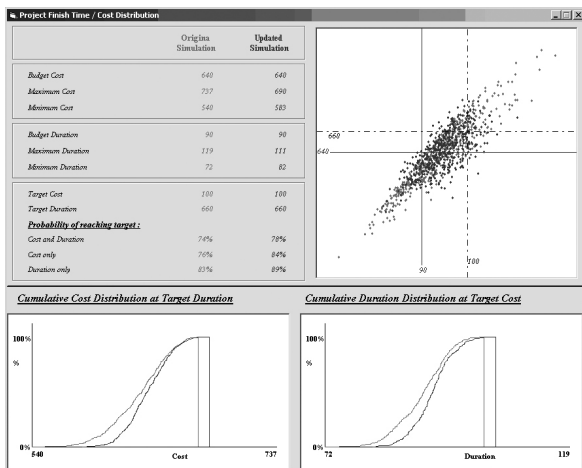


Figure 6: Project Finish information with a give target Cost and Time

The scatter plot on the right top corner of the screen is the cost – time combinations of the project finish for both simulation runs. The horizontal axis represents the project finish duration and the vertical axis represents the cost at the project finish. Each red dot on the plot represents the time cost combination at the project finish for a single simulation run of the original simulation. Each blue dot represents the project finish of a simulation run of the updated simulation. The graph at the bottom left corner of the screen provides the cumulative distribution function (CDF) - the cost at the project finish. The CDF for the duration at the project finish is generated in the plot area in bottom right corner of the window. The red lines represent the original simulation and the blue lines represent the updated simulation. The unique feature of this section of the application is that the user can obtain the probability of success for any target cost – duration combination of the project. Once the mouse pointer is clicked on the scatter diagram, the program takes the coordinates of that point as the target cost and duration for the project. After setting the target cost and duration, the program generates the following graphs and information.

1. Probability of reaching the target cost
2. Probability of achieving the target project duration
3. Probability of reaching both the target cost and duration
4. Cost CDF graphs for the instances when the target duration is met
5. Duration CDF graphs when the target project cost is achieved.

As shown in Figure 6, the intersection point of dot – dash lines on the scatter plot is set as the target cost-time combination for the project. The set target cost is 670 cost units and the target duration is 100 time units. The second set of information provides the probabilities of achieving both cost and duration targets. The probability of meeting both targets for the original simulation was at 82% while this has increased to 87% for the updated simulation. Probability of meeting the cost target regardless of the duration stands at 86% and 93% for the original simulation and for the updated simulation respectively. The probability of achieving the duration target of 100 time units was 84% for the original simulation and 91% for the updated simulation.

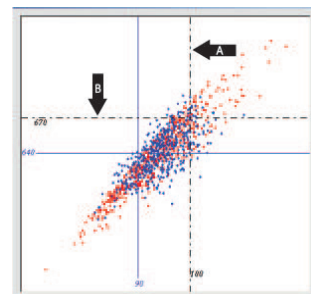


Figure 7:  
Time - Cost scatter plot  
with cost and duration  
targets.

The two charts at the bottom of Figure 5 show the CDF graphs for the project finish cost and duration respectively. With a set target, the program changes both the graphs. The chart on the left corner of the screen, shown in the Figure 7, provides the cost CDF graph for the simulation runs where the target duration was met. For example, the 20th and 80th percentile for the updated simulation are 623 cost units and 650 cost units respectively. The chart on the right corner of the output screen provides the duration CDF graph for the simulation runs when the target cost is met.

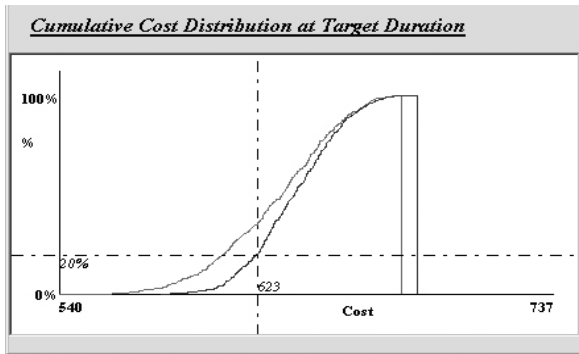


Figure 8: CDF graph for the cost for the target duration

## 6. EARNED VALUE VARIANCE AND INDICES DISTRIBUTION

The main purpose of earned value management practice is to provide an indication on the current progress of the project against the baseline. The uniqueness of earned value is that both cost and time duration targets are measured in a single parameter. Forecasting accurate cost and time parameters at the project end is also an objective of earned value management system. Estimate to completion (ETC) and estimate at completion (EAC) are two parameters used to forecast project finish details. These conventional indicators have two limitations.

1. Single value estimates: Ignores the range of other possibilities that could exist
2. Consider only the project end.

The main objective of the information generated in this section is to provide a solution that would overcome the two limitations mentioned above. The information generated includes CDF graphs of earned value variances and indices for any point of the project time line. A user can input the time point for which information needs to be generated and the type of output, whether variance or index. Figure 8 shows the screen after populating the graphs and other relevant information. The information generated is the earned value

indices at a point 45 weeks into the project. The chart on the top right corner of the screen provides the CDF graph for the Cost Performance Index (CPI) at the specified time point. The bottom graph provides the CDF for the Schedule Performance Index (SPI). The horizontal axis on both graphs is set for the index value and the vertical axis stands for the cumulative probability. The red graph represents the original simulation while the blue graph represents the updated simulation.

This is similar to a cross sectional view of the project Time – Cost distribution at a specific time point. Calculations are carried out in two steps. Initially the application isolated all the budget cost(s), actual cost and earned value relating to the specific time point that information is generated for. Subsequently, it calculates the earned value variances or indices using the equations 1 to 4 based on the user selection.

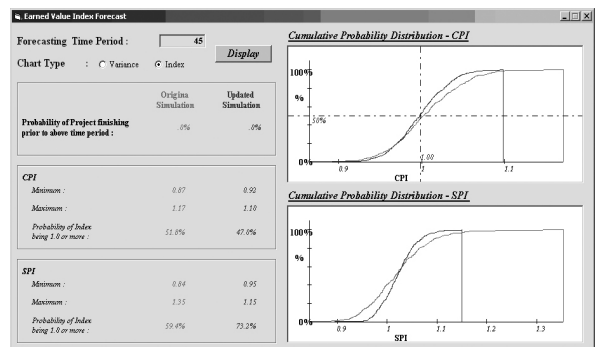


Figure 9: Populated Earned Value Index Graph

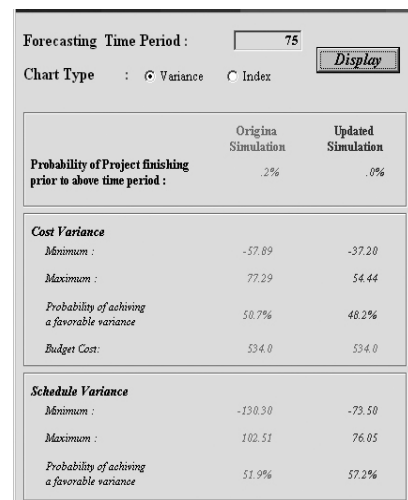


Figure 10: Information panel of earned value index forecast.

The application provides the following information on the left side of the output screen.

1. Minimum CPI/ Cost Variance
2. Maximum CPI/ Cost Variance
3. Probability of CPI being over 1.0 / Positive Cost Variance
4. Minimum SPI/ Schedule Variance
5. Maximum SPI/ Schedule Variance
6. Probability of SPI being over 1.0 / Positive Schedule Variance
7. Probability of project finishing before the set time point

A favourable earned value variance is greater than zero while a favourable index is greater than 1. Hence the probability of achieving either a positive variance or an index greater than 1 at a given time point is important information for proactive project control. The probability of variance or the index becoming favourable is arrived at by dividing the number of runs with favourable values by the total number of simulation runs. According to the information panel, the probability of reaching a favourable variance for the original simulation is 50.7% and updated simulation is 48.2%. Figure 9 shows the same information at the end of 75 weeks.

The CDF graphs of CPI and SPI indicate the possible outcomes at a certain time point. By comparing different CDF graphs for a single index across the project time line, it is possible to identify the critical time periods for cost and schedule control. Figure 10 shows the comparison between numbers of CDF graphs for the SPI at different time points for the updated simulation. As the updated simulation was carried out after the project was completed up to the 20th time point, the CDF graph at this time point is a vertical straight line. With time, the range between the maximum and the minimum points increases. This implies that probable volatility on schedule increases as time progresses. From 20th time period to the 30th time period the range increases drastically, but remains fairly constant until the 50th time period. The possible minimum value drops drastically from 50th time point to the 60th time point. Proactive planning and higher effort from the project team to keep the schedule under control is required for time periods where the volatility increases. It is possible to clearly identify such time points through careful comparison of SPI graphs at different time points.

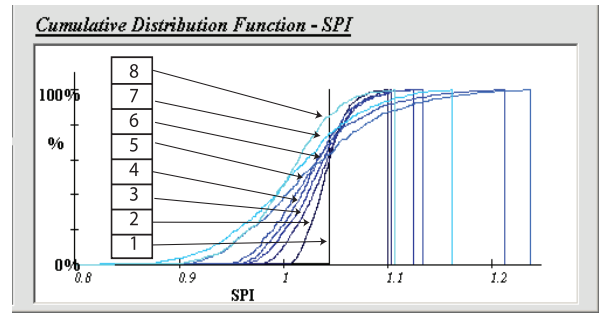


Figure 11: SPI variation from 20th time period to 80th time period

## 6. CONCLUSION

Earned Value management system is a powerful project monitoring tool, but lacks the strength as a strong forecasting tool. As the deterministic EVM system has several limitations, a new concept and application called Simulated Earned Value Management (SEVM) was developed and tested. This paper introduces the development of the SEVM that integrates the Earned Value Management with Monte Carlo simulation based risk management process. SEVM also provides the environment for the user to perform Monte Carlo simulation on time and schedule networks and obtain information in Earned Value Management parameters. The Simulated Earned Value Management tool integrates the conventional earned value management system with the concepts of probabilistic project forecasting. The tool provides a lot of/much information that can support effective project control. The capability to provide a cross sectional view at any time point on the project is a unique feature of the tool. This provides the opportunity for project managers to identify possible critical time points in the future. New information and progress details can be updated into the application with the minimum effort and the application facilitates the comparison between different situations prevailed at different time points. Probabilistic forecasting tools provide a large amount of information, which is true for the Simulated Earned Value Management tool too. The objective of these applications is to provide a better visualization about the future outcome of the project. Only a proactive and flexible project control procedures will make effective use of such application.

## ACKNOWLEDGMENTS:

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## *Beyers Vs. Secretary of State for Environment, Transport and Regions and Uttlesford District Council [2000]*

*The appellant challenged refusal of leave to fell a tree protected by a tree preservation order. The tree was old and large, and its roots had begun to undermine the claimant's buildings. The original consent to a reduction of the crown of the tree by 50% had not been accompanied by the proper certificate as to the tree's amenity value, but one was served later. The claimant had since been advised that damage could only be avoided by it being felled. He sought compensation for the damage, and the authority replied that his claim was out of time.*

*Held: The regulation required the authority's decision to be certified. That required formal notification of the decision. The certification procedure could only take place at the time of the decision, and not by a certificate issued separately. The first respondent's decision upholding the validity of the certificate was incorrectly based and ineffective.*



# Elementary Claim Preparation and Presentation



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## 1.0 INTRODUCTION

A claim is an entitlement of one party to demand for additional payment or extension of contract period or compensation for delays and damages from the other party under relevant clauses given in the contract document, which cannot be otherwise quantified from the payment schedule provided in the contract document.

Before making any claim one should satisfy him/herself that there are justifiable grounds to make any claim under any specific clauses in the conditions of contract.

We are aware that the claim may not always involve money. That means the claim could be additional time to perform the work or it may be both time and money. Furthermore, a claim may not be sought only by the Contractor, but also by the employer who may claim against the contractor. It must be remembered that the bottom line of any claim is involved with money and / or time.

Claims management is a process that should start at the inception of a construction project as an integral part of project management. With regards to claim management, it is necessary to have a sound knowledge of the categories of claims and the systematic way of analyzing them.

## 2.0 CATEGORIES OF CLAIMS

Basically there are many categories of claims. This paper considers only the following categories:

1. Contractual Claims
2. Extra Contractual Claims
3. Ex-gratia.

### Contractual Claims

In this regard conditions of contract provide events / circumstances of the claim in question and provide remedies

as well. For an example, it can illustrate extension of time claims pursuant to clause 44 in FIDIC-87 standard conditions of contract and this has been taken as theme for the discussion of this paper.

### Extra Contractual Claims

Where the contract does not provide provision for a claim event, these claims can be considered under the law of the land. The best example for this is when the contract does not have any provision for liquidated damages the client may be able to claim his damages for the contractor's delay in the performance under the law through the litigation process.

### Ex-gratia

For these kinds of claims, there is neither legal ground nor legal right to claim.

For example, when a particular material price goes up within a very short period and pursuant to the condition of contract if no provision is made for the price fluctuation, then the contractor has no right to claim for price escalation contractually. In these situations client may consider this ex-gratia basis and may make payment for the escalation.

## 3.0 DELAY CLAIMS

Key role of claims in a construction project is the delay in work. It would be easy to analyze delay claim if only one party is responsible for the delay. As we are aware the construction claim involving delays is among the most complicated and difficult matters to analyze mainly due to various parties creating delays. It may categorize as concurrent delay to the project.

### Categories of Delays

Basically there are three categories of delays.

1. Excusable compensable delays
2. Excusable non compensable delays
3. Non excusable delays



## Excusable compensable delays

Contractor is entitled for these kinds of delays for an extension of time and delay damages. These delays are within the control of or are due to the fault of the client or a third party for whom the client is contractually responsible.

The following cases can be examples of delays: the failure to grant site access as agreed; delays resulting from change orders; faulty design; incomplete drawings and specifications; late arrival of client furnished material, equipment etc.

## Excusable Non Compensable Delays

The contractor is entitled to time extensions without monetary damages. In brief, these are delays for which neither party is at fault.

Natural disaster, unusually severe weather; unforeseen labour/material shortages etc. are the some examples for this category.

## Non Excusable Delays

These are responsibilities of the contractor. The Client may be entitled to liquidated or other damages from the contractor for these delays.

Low productivity; non availability of the required resources; non-removal of defective work etc, are a few examples for non excusable delays.

## 4.0 PREPARATION OF CLAIM

Consider preparation of a claim for additional money under clause 53 and extension of time under clause 44.

In order to succeed in the claim it is essential to have a sound, comprehensive and persuasive claims submission.

### 4.1 STEP ONE – Serving Claim Notice:

A written notice is to be given to the engineer indicating the contractor's intention to submit a claim. Ideally the letter should include:

- 1 An explanation of the circumstances giving rise to the claim
- 2 An explanation of why the contractor considers the employer liable for the cause of the claim
- 3 A stating of the relevant clause(s) of the conditions of contract under which the claim is being made.

Inclusion of the above information in the notice will enable the engineer to consider the principle of the claim at the earliest possible time.

It has been held that a notice of intention to claim is met if the notice simply states that a claim situation is exists in general terms. This will suffice as a notice of intention to submit a claim.

A clear understanding of the two aspects of claims under the contract is their contractual validity and the qualification of any payment or time. Those concerned should not get engrossed in the complexities of quantification if there is no contractual basis for payment or an award of time. Unless the grounds of the claim are given in the notice much effort could be wasted in the preparation of the submission.

## 4.2 PREPARING THE CLAIM

The possible headings for the claim submission report would be as follows:

- I). Introduction
- II). Basis of Claim
- III). Details of the Claim
- IV). Evaluation of the Claim
- V). Appendices

### 4.2.1 Introduction

This should state the contract particulars; names of parties; a description of the works; details of tender; the form of contract; the tender sum; dates for commencement and completion etc.

### 4.2.2 Basis of the Claim

This is a statement giving the contractual reasons for believing that the client is liable for the extra costs with reference to the clauses under which the claim is made.

### 4.2.3 Details of the Claim

This refers to a statement of the relevant events giving rise to the claim stating how circumstances have changed from those that could reasonably have been foreseen at the time of tender. These details may include reference to contemporary and other records.

### 4.2.4 Evaluation of the Claim

The claim shall be substantiated with detailed calculation and analysis such as updated programmes, records (diaries, meeting minutes), and invoices etc. which are related to specific figures, amounts and percentages used in the calculation.

#### 4.2.5 Appendices

This should contain copies of programmes, all relevant correspondence, records and supporting information such as invoices, photographs etc. referred to in the claim details and evaluation sections of the submission. Should any substantiating documentation be considered confidential, for example salaries of staff, the contractor should arrange for these to be viewed in confidence, by the engineer.

#### 5.0 PRESENTATION:

Having now got all the required information and documentation it should be compiled logically and submitted in a timely manner. It is of course essential to pay attention to the format in which the claim is presented.

### *Rylands Vs. Fletcher (1868)*

*The defendant had constructed a reservoir to supply water to his mill. Water escaped into nearby disused mineshafts, and in turn flooded the plaintiff's mine. The defendant appealed a finding that he was liable in damages.*

*Held: The defendant was bound 'sic ut suo ut non laedat alienum'. "The defendants, treating them as the owners or occupiers of the close on which the reservoir was constructed, might lawfully have used that close for any purpose for which it might in the ordinary course of the enjoyment of land be used; and if, in what I may term the natural user of that land, there had been any accumulation of water, either on the surface or underground, and if, by the operation of the laws of nature, that accumulation of water had passed off into the close occupied by the plaintiff, the plaintiff could not have complained. . . On the other hand if the defendants, not stopping at the natural use of their close, had desired to use it for any purpose which I may term a non-natural use, for the purpose of introducing into the close that which in its natural condition was not in or upon it, for the purpose of introducing water either above or below ground in quantities and in a manner not the result of any work or operation on or under the land, - and if in consequence of their doing so, or in consequence of any imperfection in the mode of their doing so, the water came to escape and to pass off into the close of the plaintiff, then it appears to me that that which the defendants were doing they were doing at their own peril; and, if in the course of their doing it, the evil arose to which I have referred, the evil, namely, of the escape of the water and its passing away to the close of the plaintiff and injuring the plaintiff, then for the consequence of that, in my opinion, the defendants would be liable."*

## The Risk Management Process



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### 1.0 Introduction

- 1.1 Risk is present in all projects and the quantity surveyors (Qs) as a part of the project team are often involved in making decisions which have a major impact on risk.
- 1.2 To explain the risk management process in layman language, consider an event such as crossing the road. We face the risk of being killed or being seriously injured by a vehicle, but that doesn't prevent us from crossing roads. Whether we realize it or not, we all go through a quick mental process to assess the risk and take appropriate action. First, we identify that there is a risk. If we don't, we leave things completely to chance, which is dangerous. Second, we estimate the scale of the risk: we automatically take into account the road width, the surface conditions, visibility, the density and speed of traffic and so on. We might also consider our own physical capabilities and other factors such as whether we've got children with us or whether we're running late for an important appointment. We perform a mental calculation that weighs all these factors and assesses the risk. Without thinking deliberately about it, we then balance the likelihood of being hit by a car against the consequences. In fast-moving traffic, we may get killed; in slow-moving traffic, cars may stop for us.
- 1.3 As individuals we make a decision about when and where to cross a road. We do not avoid risk altogether; we manage it through some deliberate action. We use a pedestrian crossing, we wait until the traffic diminishes - or we simply accept the risk, hope for the best and make a dash for it. Why will some people run across a busy road while others always wait patiently at a pedestrian crossing for the lights to change, even if there's not much traffic? It's because we all perceive risks differently as a result of our upbringing, our education and our personality. It can also be influenced by cultural factors and our own experiences. If we've had a near miss ourselves or know someone who has been injured or killed in a road accident, this is likely to influence whether we're risk takers or risk-avoiders when it comes to crossing roads.
- 1.4 The fact that people don't approach risk in the same way makes managing risk in a project team environment a challenge. The process follows similar principles, but it is more complicated, of course. One complication is that project teams are collectives of people with different views of the conditions, different experiences and different attitudes to risk. For example, Qs are seen as risk-averse, while architects are seen as more risk-orientated. Another complication is that team's objectives are far more complex than those of individuals, because team members are trying to satisfy a range of stakeholders, whose attitudes may also vary. There are different risk management models, but the following process contains six key steps.

### 2.0 Identify the risks

- 2.1 Risks are an everyday part of life, so project teams need a system to identify all those they face. This involves collecting information from a variety of sources, for example:
  - 2.1.1 Research: While exactly the same project will not have been executed before, something similar will have been. Projects on neighboring sites or projects previously undertaken by the client should be investigated.
  - 2.1.2 Structured interviews/questionnaires: Interviews with key members of the project team and stakeholder groups will elicit the greatest insight into the risks of the project and how they are perceived by individuals.
  - 2.1.3 Checklists/prompt lists: A simple and effective way to stimulate the team into thinking about risk is to use a checklist. An easy way to start a checklist is for each team member to write down the major variations in their previous projects, with the reasons for their issue.

2.1.4 Brainstorming in a workshop environment: Bringing the team together in a focused workshop creates a powerful environment in which to discuss risk. The team can have a better understanding of how each member perceives risk differently. One important aspect of such workshops is that lateral thinking is encouraged. The workshop gives the team an opportunity to experiment with different viewpoints which individuals might normally reject out of hand if working alone.

### 3.0 Assess their impact.

3.1 Once the risks have been identified, some assessment needs to be made of their likely impact. This involves quantifying the risk in some way. We might conduct computer simulations, cost-benefit analyses, use a Delphi technique (Delphi technique involves a panel of experts providing views on various events to be forecast such as inventions and breakthroughs or even regulations or changes over a time period in the future)

or apply probabilities, statistical tests or sensitivity analysis. Alternatively, we may rely on subjective judgments.

3.2 For each of the risks identified, its probability and impact should be assessed, normally in a workshop environment with key stakeholders present.

3.2.1 Probability - this is the likelihood of the risk occurring and is generally expressed as a percentage; and

3.2.2 Impact - if the risk occurs what impact it would have on meeting the project's objectives.

3.3 A scale should be set according to the needs of a project for the probability and impact dimensions. Setting a common scale will ensure a consistent approach to placing newly-identified risks on the matrix at a later stage in the project life cycle.

	PROBABILITY	IMPACT	
		Cost	Time
High	>66%	>66%	>66%
Medium	33%-66%	33%-66%	33%-66%
Low	<33%	<33%	<33%

Figure: 1

3.4 For example a two dimensional analysis of risks to assess the severity of impact and the probability of occurrence can be carried out as shown on figure 1:

3.5 A higher level of sophistication can be applied to the ranking of the risks on the probability/impact matrix.

### 4.0 Map the risks

4.1 This involves prioritizing the most critical risks by mapping the probability of each risk eventuating against the consequences of its eventuation. Project teams may use a simple high -low scale for both likelihood and

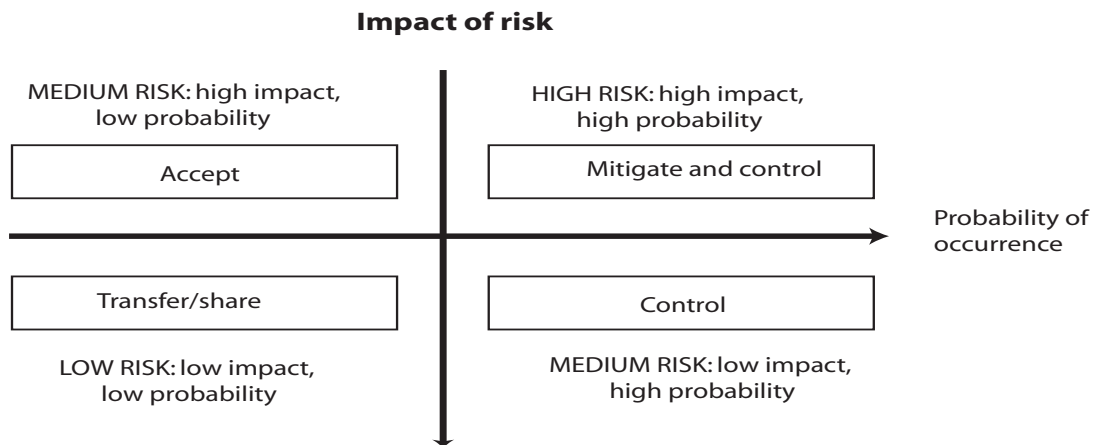


Figure: 2

consequences or they may use a more complex scale. Whichever one they use, prioritization is important because the team typically may face many risks, and only the most significant ones can be managed.

- 4.2 An indicative simple high – low mapping is shown on figure 2:

## 5.0 Record risks in a register

- 5.1 The risk register lists the risks that have been identified together with the likelihood and consequences of the occurrence of each one. This is a comprehensive register that ensures that risks are constantly evaluated. But mapping ensures that the biggest risks get the most attention. Risks are often grouped into categories in the register to make many related risks more manageable.

- 5.2 Typical column headings for a risk register are:

- Risk number - a unique identifying number for the risk
- Risk description - a written description of the risk
- Ownership-who is responsible for the management action in responding to the risk
- Probability - how likely is the risk to occur
- Impact - what happens if the risk does occur
- Risk factor - probability multiplied by impact
- Response - what actions need to be taken to deal with the risk
- Status - the status of the risk can be shown as:
  - done: the risk has arisen and been dealt with;
  - active: the risk is currently being managed; and
  - monitor: the risk has been identified but no analysis or response has yet been developed for it.
- Comments - allows notes to be kept on the risk.

## 6.0 Risk Response

- 6.1 This involves evaluating the risks against the stakeholder's appetite for taking them. Based on this evaluation risks should be avoided, reduced, transferred or accepted.
- 6.2 An important point to consider when developing responses concerns the generation of secondary risk. When a response is proposed, its full implications

should be assessed to ascertain if a secondary risk arises out of implementing the response. If the sum of the secondary risk plus the reduced risk (the original risk with the response in place) is greater than the original risk, then an appropriate response has clearly not been identified and an alternative should be found.

- 6.3 The tools available are not usually related purely to risk management. For instance, most QSs would recommend to their clients that the contractor has third party insurance for the project. This is a risk management response designed to reduce clients' exposure to claims for damages if a particular incident were to occur. This is a risk management tool, although most QSs would consider it to be common project procedure. Typical tools available are:

- Insurances/bonds/warranties;
- Contingency plans;
- Forms of contracts;
- Contingency drawdown models;
- Special cost schedule allowance;
- Earned value analysis;
- Resource leveling; and
- Training.

## 7.0 Report the risks

- 7.1 This informs the relevant stakeholders about the risks associated with the project and responses to them by explaining how the project team may be able to manage the risks which they have identified. Only the biggest risks, in terms of their likelihood and consequences, need to be reported. Risk reports should show both the gross risk (before controls are introduced) and the net risk (after the effect of controls is taken into account) to demonstrate the cost effectiveness of those controls.

## 8.0 Conclusion

Risk management at individual level has a great deal in common with how it's done at project team level. The six step process is a good way to think about how Quantity Surveyors may deal with the risk that they face.

# Construction Contract Arbitration



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## 1. General Introduction

Arbitration is a process whereby two parties agree to have a dispute arising from a contract between them settled by an independent third party chosen by the contracting parties and to be bound by the decision he/she makes. This agreement may be entered into after the dispute has arisen or it may be included in a contract by way of a clause which refers to any future dispute which might arise out of that contract of arbitration. As in the construction contracts, many of the issues are of a technical nature, parties preferring to refer their disputes to a person who understands the technical issues involved and the usual practices of the construction industry.

In view of the wide range of work covered and the likely disputes that could arise between the contracting parties, the procedures adopted for arbitration in the construction industry tend to cover the whole series from the very formal to the very informal. The independent third party (Arbitrator) may be chosen by agreement between the parties themselves or he/she may be appointed by a person named in the contract to carry out that function.

Arbitration depends for its efficacy upon a framework of law within which it is recognised: for without such a framework the award of the arbitrator could be worthless if the losing party chose to ignore it.

There are three essential elements of arbitration, namely:

- a. The existence of a dispute between the contracting parties
- b. An agreement between them to refer it to the arbitration, and
- c. Both parties agreeing to be bound by the decision of the arbitrator

Arbitration will be selected by parties as the agreed contractual method of resolving disputes for various reasons, among which will be:

- a. They consider that it is appropriate for a dispute between them to be resolved by independent third party who is familiar with the technicalities of their field.
- b. The familiarity of the arbitrator with the technical aspects of their dispute will lead to economies of time and cost in resolving the dispute.
- c. They require the privacy which arbitration provides.
- d. Arbitration can be completed without the long delays inherent in the Court process.

## 2. Legal Definition

An arbitrator is a private judge, chosen by the parties' mutual consent to determine disputes between them. He is not a judge sitting in a court provided and financed by the system. He is an independent professional who, in addition to his knowledge of the matter in dispute, should preferably have some considerable experience of the arbitral process.

Arbitration is a voluntary procedure, available as an alternative to litigation, and enforceable through the courts, where the parties have entered into a valid arbitration agreement. In such cases the right of either party to have the dispute resolved by arbitration will be sustained by the court under the Arbitration Act of the country.

## 3. Arbitration in Comparison with Other Forms of Dispute Resolution

### 3.1 Comparison between Arbitration and Litigation

Where litigation is used the process can be slow in itself due to the procedures that have to be followed and it can take considerable time for a dispute to get before the Court. The limited capacity of the Court may result in, if it is the only method of formal dispute resolution available to the parties to a dispute, the whole process coming to a standstill. It is bound by formal procedures and in particular by Rules of the Supreme Court. It is always an adversarial process in



common law jurisdictions. This can lead to a considerable expenditure in costs of preparatory work and the detailed procedures that have to be followed. The great advantage is that the services of the judge and the accommodations for the trial are provided by the state. Judges are also possessors of far greater powers than arbitrators. Legal aid is also available in certain circumstances in litigation.

Arbitration, on the other hand, where both parties to a dispute want it to be resolved and to get on with their respective businesses, provides a wide variety of procedures which can be adopted. It is possible to conduct entire process of arbitration without a formal hearing and on documentary submission alone, so that the arbitrator can make his/her award at minimal cost to the parties. Arbitration can, however, suffer all the same problems of delay and cost as do the courts especially where there has been a one-sided application to a person named in the contract and the other party is, for reasons best known to itself, seeking to delay matters. However, if one party relies on dilatory tactics to drag the proceedings, Arbitrator may use its power (vested by the Rules or statute) to penalise him/her and reduce delays.

### 3.2 Comparison between Arbitration and Mediation / Conciliation

A majority of disputes have always been settled by negotiation. Where negotiation fails, conciliation and mediation can be used instead. Conciliation and mediation are procedures whereby an independent, impartial person assists the parties to reach an agreed settlement of their dispute. The difference between the two processors is that there is no obligation on the mediator other than to facilitate the possibility of settlement whereas the conciliator may, if necessary, offer a suggested solution to the dispute for the parties to consider. The process in either case is voluntary. If the parties reach a settlement as a result of the process, once recorded, it becomes a contract between the parties which is enforceable.

The great disadvantage of mediation and conciliation is that they do not necessarily produce a resolution to the dispute. If they do not resolve the dispute the parties then have to resort to arbitration or litigation. Even if a settlement is reached the resultant agreement is only enforceable in contracts which is optional and may be disputed if one party does not wish to honour it.

There is currently a trend towards the development of dispute resolution procedures within contracts which include a formalised conciliation stage as a predecessor to arbitration. These include the institution of Arbitrators' Consumer Dispute Resolution Scheme. Other contracts published by

the institution of civil engineers, the ICE Sixth edition 1991 and the ICE Minor works contract (1988) includes conciliation procedure but in these contracts referred above it is optional, as is the conciliation procedure included in the federation of civil engineering contractors's sub-contract (September 1991).

### 3.3 Comparison between Arbitration and Adjudication

Arbitration and adjudication are similar in one respect. They both seek to establish the contractual rights, duties and obligations of the parties. Both the arbitrator and the adjudicator have to in principle act in a way that complies with the concept of fairness. An adjudicator can be named by the parties in the agreement or once a dispute has arisen adjudicator can be agreed by the parties or failing these options, the adjudicator can be appointed by a third party.

Adjudication has been described as 'rough justice', and 'a quick and dirty fix', and there is no doubt that the goals of those defending adjudication are that it is better to obtain the decision of a respected professional on the basis of limited information in a very short period of time than to spend months, if not, years reaching a similar result at vast expense. There are possible problems with the application of such a process to major disputes. In that, the obligation to pay large sums of money as a result of a possibly superficial examination of the facts may not go down too well with the paying party. The hoped-for alternative is that this result will be accepted and the dispute thus resolved without the expenditure of vast sums of money in litigation or arbitration cost.

The ideal is, of course, to restrict the adjudication to resolve issues before there has been the opportunity for large amounts of money to become the subject of dispute. The opportunity to seek the decision of an adjudicator at any time may well mean that each aspect of what might finally turn out to be a complex dispute has been examined and resolved as the work proceeds.

A useful example is the typical construction dispute which resolves around a multitude of events which may or may not have caused delay or disruption. If each of these events can be examined by an adjudicator and a decision reached as to the effect of each of them, the opportunity for the development of a complex claim is very much reduced.

The principal difference between arbitration and adjudication, other than the time scale for making the decisions, is the aspect of finality. Whilst a decision reached by an adjudicator

cator is as binding on the parties as an arbitrator's award, the dispute that has been the subject of adjudication proceedings can be the subject of completely fresh arbitration or litigation. The adjudicator's decision remains in place and must be honoured whilst the arbitration or litigation reconsiders the dispute from first principles.

It may be thought from the experience of the number of arbitrator's awards in construction matters that have been the subject of subsequent court proceedings, that arbitration, at least in the construction industry, does not even have the benefit of finality. This however is not the principle. The awards that get into the courts are a minority, however well publicised; most construction arbitrators' awards are accepted by the parties and no further proceeding result.

An adjudicator's decision may, as a result of the existence of an arbitration clause in the contract, have to be enforced by an arbitrator.

### **3.4 Comparison between Arbitration and Expert Determination**

An 'expert' can be appointed to determine a dispute between two parties in a similar way to an arbitrator, a mediator or an adjudicator. He/she can be agreed between the parties or he/she can be appointed by a third party. He/she can also, as with an adjudicator, be named in the contract.

Whilst adjudicators and arbitrators may use their own expertise if so agreed by the parties, this is not always the case. Expert determination is distinguished by the fact that it specifically imagines that the expert will use his own expertise.

The procedure is usually a simple one and based upon the wording of the specific contract. The main difference between expert determination and arbitration is that the former is subject to little or no control by the courts. Experts are appointed entirely on a contractual basis and may be liable for negligence. Unless an expert gives reasons, his/her determination is unlikely to be appealable. The decision that the expert makes has a completely different status from that of a judge or arbitrator. It is only enforceable as a contractual provision.

### **4. Advantages of Arbitration over Other Forms of Dispute Resolution.**

The principal advantages of arbitration are that it produces a legally binding decision by means of a process that is, if desired, totally within the control of the parties and that it can be flexible as necessary to suit their requirements. The following are some of the advantages:

#### **4.1 Freedom to Choose the Arbitrator or the Tribunal**

The freedom to choose the arbitrator or the tribunal is perhaps the most important single advantage that arbitration has over litigation in domestic arbitration, and one of the most important in international arbitration. If the parties cannot agree upon a particular person or persons, they can almost invariably agree upon some institution to make the appointment, and thereby agree upon the qualifications of the person or persons to be appointed. Frequently disputes arising from construction contracts involve such questions as whether or not the ground conditions encountered could have been foreseen by an experienced contractor having regard to the subsoil information available to the contractor at the time making the contract, whether or not the issue of drawings or instructions on certain dates caused delay to the works, whether or not variations ought to be valued at contract rates or in some other way having regard to the provisions of the contract. A proper understanding of those and many other issues likely to arise can usually be gained only by years of experience both as a contractor and as engineer under the contract. Hence it is often desirable that the arbitrator should be an experienced engineer (or, where appropriate, architect or quantity surveyor); and this objective is often achieved, if not by agreement of the parties as to their choice of the arbitrator, by naming as the appointing authority the president of the appropriate professional body. If the parties cannot even agree upon an appointing institution, the court will appoint an arbitrator and before doing so will consider any submissions as to what qualifications the person appointed should possess.

While it is recognised that technical expertise is available to litigants through the appointment of experts, there is a very real danger that a non-technical judge may be influenced more by the powers of presentation and of persuasion of the expert before him by the technical merit of his evidence.

#### **4.2 Flexibility**

Disputes arising from construction contracts involve sums of money varying from a few thousand pounds to hundreds of millions. They may involve questions of law or of fact or both, and the question of law may arise either from the construction of standard forms of contract or from "one-off" terms in a contract; while the question of fact may be simply what happened during the construction, or what might have been foreseen by an experienced professional.

The credibility of witnesses of fact may or may not be in question. All of these matters affect the choice of an appropriate procedure and the form and level of representation, if any, of the parties.

In arbitration the parties are free to determine these matters by agreement; and while neither party can dictate to the other as to its choice of representation, a party may bring to the notice of the arbitrator a contention that costs are being incurred unnecessarily by its opponent, and may request that this be taken into account in the arbitrator's award of costs. If a party to a contract does not wish to be exposed to the decision of one person, with the consequential possibilities of particularities or ignorance, he/she can stipulate for arbitration by a tribunal of three, one of whom is to be appointed by him/her. This possibility is of particular importance where the parties to a contract are from different countries or cultures; it can be sure that the tribunal will include at least one member familiar with his/her country or culture.

### 4.3 Economy

Critics of arbitration often argue that total costs are likely to exceed those of litigation, because in the latter the judge and court facilities are provided at public expense, while in arbitration both the arbitrator and facilities for the hearing have to be paid for by the parties. While true, this is not usually a major factor in the total costs of the proceedings, the arbitrator's fees often being much less than those of counsel appealing before him. Second, where technical issues are involved, experts may be needed to explain such issues to a technically lay judge, but not to an arbitrator having appropriate technical knowledge. And third, proceedings before a judge are likely to be lengthier, and hence more costly, than before an arbitrator having the knowledge needed to recognise the technical issues.

Economy is not however achieved automatically by the use of arbitration in preference to litigation, but it maybe achieved where the parties at sensibly in choosing their arbitrator, the form of the proceedings, and their representation. Where a party wishing to act sensibly is opposed by one whose aim is otherwise perhaps to prolong the reference and hence to defer the Day of Judgment – such behaviour should be brought to notice of the arbitrator, who may take it into account in his award of costs. Except in the little number of cases in which the right of appeal has not been excluded by agreement and leave to appeal is given, the arbitration procedure is private, self-contained and final. In comparison with court proceedings, the risk of costs and delays due to appeal is minimal.

### 4.4 Expedition

It is especially important in construction contract disputes, which often involve voluminous documentary evidence and a need to rely additionally upon oral evidence, that delay in their resolution should be avoided. Any such delay may

result in documents being lost, dispersed or destroyed: while oral evidence may become less reliable because of fading memories, and dispersal or death of witnesses. Real evidence of buildings, structures, or other works may become covered or altered by continuous process of the construction or later development, adding to the difficulty of identifying the assessing alleged defects. Properly used, arbitration can provide a means whereby disputes arising from construction contracts can be resolved more readily than in litigation.

Arbitration by a tribunal chosen with speed in mind can be far quicker than litigation. The tribunal can take part in the preparation of the issues for adjudication, can help to strip out the inessentials, and can read the documents before, rather than at the hearing. This can be enormously shorten the hearing and reduce time and costs.

### 4.5 Privacy

Arbitration proceedings, unlike those in the courts, are not open to the press or the public: only those persons involved in the proceedings are entitled to attend the hearing and meetings that are usually needed. Others not directly involved may be invited to attend by agreement of the parties; and frequently such invitations are extended to, for example, pupils of the arbitrator who wish to gain experience. Attendance is however permitted on the condition that such pupils or others will respect the confidentiality of the proceedings. In many cases the parties to arbitration proceedings have no wish to publicise details of their dispute. As is sometimes the case, a previously harmonious relationship- perhaps between a main and a subcontractor - is interrupted by a dispute, amicable relations are usually more readily restored where publicity has been avoided.

## 5. Disadvantages of Arbitration

### 5.1 Costs of the Arbitrator and of Court Facility

In contrast to litigation, where both the judge and the court facilities are provided at public expense, the parties to arbitration, or one of them, will ultimately have to bear the costs of the arbitrator and courtroom facilities. However in many cases such costs are small in comparison to other costs incurred in litigation.

### 5.2 Incompetent Arbitrators

While judges are appointed only after they have gained extensive legal knowledge and experience, usually at the Bar, arbitrators having inadequate qualifications and experience may be, and sometimes are, appointed either by an appointing authority or by the parties, in ignorance of the requirements of the appointment.

Many appointing authorities now maintain panels of qualified arbitrators; some require candidates for listing on those panels to qualify from the Chartered Institute of Arbitrators (U.K) before sitting the professional body's own examination. Parties seeking to make appointments by agreement are well advised to propose only persons whose names appear in the appropriate lists and can be seen to have the necessary knowledge and experience.

## **6. Arbitration Agreement**

An agreement by the parties to submit to arbitration any disputes or differences between them are the foundation stone of modern international arbitration. If there is to be a valid arbitration, there must first be a valid agreement to arbitrate. This is recognized both by national laws and by international treaties. For example, under the New York Convention and the Model Law (International trade law by United Nations), recognition and enforcement of an arbitral award may be refused if the parties to the arbitration agreement were under some incapacity, or if the agreement was not valid under its own governing law. The Model law has assisted many countries in South Asia to modernize and harmonize their respective Arbitration laws facilitating the application of the New York Convention on the Recognition of Enforcement of Foreign Arbitration Awards of which Sri Lanka is a party signatory along with more than 100 other nations of the world.

An arbitration agreement may be spelt out in the main contract, as an "arbitration clause" or it may be set down in separate "submission to arbitration". Whichever way it is done, there must be an agreement. If there is no agreement, there can be no valid arbitration. Moreover for all practical purposes of enforcement, there must be written evidence of the agreement to arbitrate.

The requirement of writing is to be found both in international treaties and in domestic law. The New York Convention, for example, will only give recognition and enforcement to an arbitration agreement if it is "in writing". The Convention defines this by saying:

"The term 'agreement in writing' shall include an arbitral clause in a contract or an arbitration agreement, signed by the parties or contained in an exchange of letters or telegrams"

The rapid development of modern methods of communication has left this definition looking distinctly old-fashioned, at a time when contracts may be concluded by telex, fax or e-mail. The model law sets out a more modern definition

of the term "in writing". It includes agreements made by any means of telecommunication "which provides a record of the agreement"; an exchange of statements of claim and defence in which "the existence of an agreement is alleged by one party and not denied by another", and reference in a written contract to a document which contains an arbitration clause.

Most modern laws of arbitration are concerned to define the requirements for "writing" as widely as possible to the point where it has been suggested that in the English Arbitration Act of 1996, "writing" has now been so defined as to include an agreement made orally.

An arbitration agreement drawn up to deal with disputes that have already arisen between parties is generally known as a submission agreement or compromis. It is usually a fairly detailed document, dealing with the constitution of the arbitral tribunal, the procedure to be followed, the issues to be decided and other matters. At one time, it was the only type of arbitration agreement recognized by the law of many states, since recourse to arbitration was only permitted in respect of existing disputes. In some states like Brazil, this is still the position.

Most states, however, are prepared to recognize the validity of arbitration clauses that relate to future disputes. In fact, most international arbitrations take place pursuant to an arbitration clause. Such clause is often one of the standard clauses of standard forms of contract that are internationally accepted such as FIDIC, ICE conditions, JCT80, ICTAD conditions etc. The well known Red Book (FIDIC) under sub-clause 67.3 Arbitration, for example, contains within its many pages of terms and conditions of contract for use in major international civil engineering projects, a provision for disputes to be referred to arbitration under the ICC (International Chamber of Commerce) Rules.

## **7. Arbitration Agreements/Clause in Standard Forms of Contracts in Construction Industry**

### **7.1 The FIDIC Conditions of Contract**

The Federation Internationale des Ingenieurs-Counseils - FIDIC (International Federation of Consulting Engineers)

FIDIC forms of contract have been in use in the Middle East since the 1970s. It is paradoxical that although the FIDIC conditions of contract have been drafted on the basis of English common law principles, the public and private sectors in Gulf countries who source their law from a mixture of civil

law and shariah law such as the UAE, The Kingdom of Saudi Arabia, Kuwait and Oman, have based their conditions of contract on the FIDIC form. Historically, the public sector in those countries have led the way for FIDIC to be adopted or used in response to the national tendering laws and the corresponding requirements of various government ministries. It is worth noting that although the Emirate of Abu Dhabi has recently and officially adopted the FIDIC form 1999 edition, the Emirate of Dubai, (particularly the Dubai Municipality & Roads and Transport Authority) has yet to follow the same lead. The current standard conditions of Dubai Municipality and Dubai Roads & Transport Authority (the main public bodies in Dubai) are based on FIDIC 1987 edition.

FIDIC Conditions of Contract for works of civil engineering construction, 4th edition 1987 (reprinted 1992 with amendments), commonly known as the FIDIC Conditions, follow closely the ICE conditions, both in content and in format, with only minor adjustments to provide for its international nature. Clause 67 of the FIDIC conditions deals with the settlements of disputes, and again follows closely the provisions of clause 66 of the ICE conditions (sixth edition) except for the arbitration agreement. The clause provides for an initial reference of the dispute to the engineer, and for his/her decision to be given within 84 days of the reference. That decision becomes final and binding unless within 70 days of receipt of the decision, or where no decision is given, within 70 days of the expiry of the period of 84 days, either of dissatisfied party gives notice to the other of its intention to commence arbitration proceedings. Thereafter arbitration must not be commenced unless an attempt has first been made by the parties to settle the dispute amicably. However, whether or not such attempt has been made arbitration may be commenced 56 days after giving notice of arbitration.

The arbitration clause provides that unless otherwise specified in the contract, and where a decision of the Engineer has not become binding, the dispute shall be settled under the rules of conciliation and arbitration of the International Chamber of Commerce (commonly known as ICC rules) by one or more arbitrators appointed under those rules. The tribunal has full power 'to open up, review and revise any decisions, opinion, instruction, determination, certificate or valuation of engineer related to the dispute'. The parties are not limited in the proceedings before the tribunal to the evidence or the arguments put before the engineer for the purpose of obtaining his/her decision pursuant to the clause; and his/her decision does not disqualify the engineer for being called as a witness and giving evidence before the tribu-

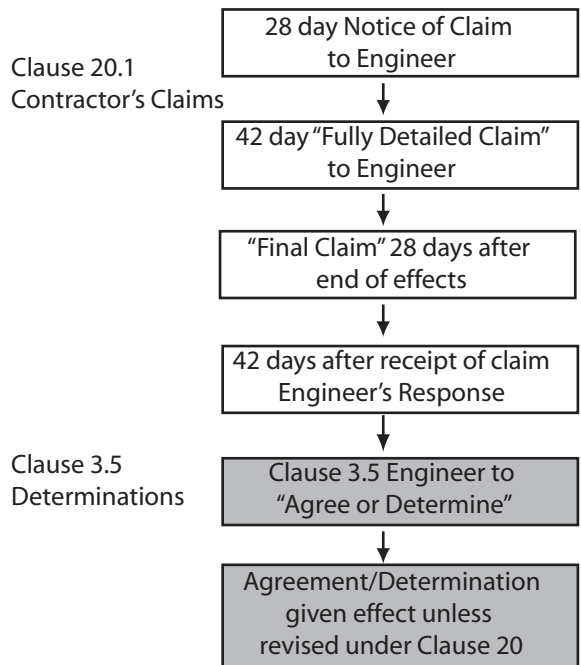
nal. Where English procedural law applies to the arbitration, section 15 of the 1996 act provides that unless otherwise agreed there shall be a sole arbitration. It is clearly defined in the contract as being English law, no further action is necessary in order to achieve that intention.

The 4th edition of FIDIC 1987 mirrored the ICE Conditions in providing for an Engineer's Decision (Clause 67) as a condition precedent to arbitration. The 1999 Supplement to FIDIC-87 replaced the Engineer's Decision with reference to a Dispute Adjudication Board (Clause 67) and the 1999 edition of FIDIC (commonly known as 'Red Book') provides a pre-action sequence of:-

- Determination by Engineer (Clauses 3.5 & 20.1) – in respect of certain matters only.
- Reference to Dispute Adjudication Board (Clause 20.4)
- Optional Amicable Settlement (Clause 20.5)
- Arbitration (Clause 20.6)

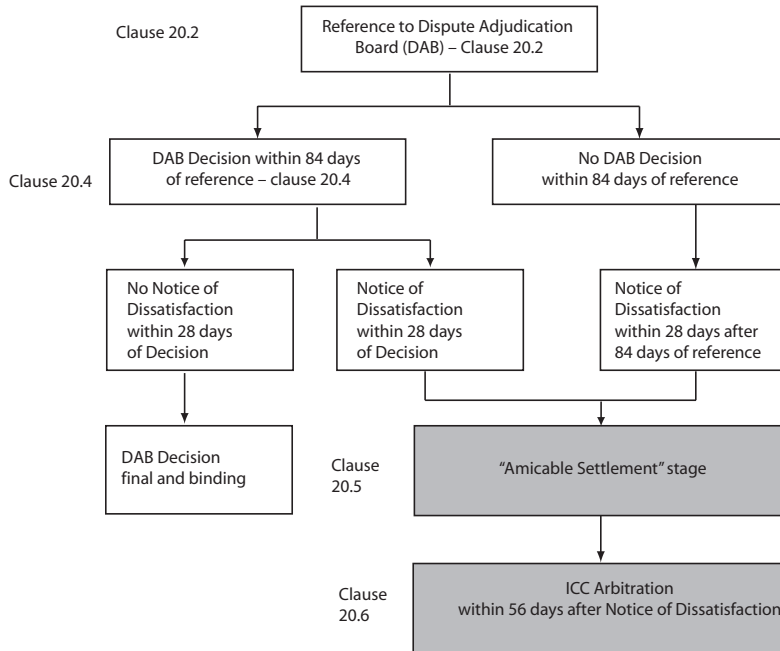
The FIDIC 1999 (Red Book) claim and dispute resolution procedure can be illustrated as follows;

## Procedure for Contractor's Claim





## Procedure for Dispute Resolution;



## 7.2 The ICE Conditions of Contract (published by Institution of Civil Engineers, UK)

Clause 66 of the sixth edition and clause 28 of current (seventh) edition of the ICE Conditions of Contract, and earlier editions of that form, incorporate an arbitration agreement within the meaning of English Arbitration Act 1996. Hence any contract incorporating the ICE Conditions includes a valid arbitration agreement, and it provides for appointment of the arbitrator, failing agreement, by the President (or a Vice President) of the Institution of Civil Engineers. The clause is heavily defined by provisions intended to promote settlement of dispute before arbitration is invoked, and to provide additional powers to the arbitrator during his/her conduct of the reference. In particular it includes an important additional power; namely – to open up review and revise any decision, opinion, instruction, direction, certificate or valuation of the engineer. The power is vested only in an arbitrator appointed pursuant to the arbitration agreement.

This clause provides that a dispute is deemed to arise when one party serves on the other a 'Notice of Disputes stating the nature of dispute'. Such notice may be given only after the party giving it has invoked any procedure available elsewhere in the contract in connection with the subject matter of the dispute, and has allowed reasonable time for such

procedure to be followed. The dispute so notified is settled by the engineer under the contract, who is required to give his/her decision in writing within one month of the notice in a case where a certificate of works has not been completed, or within three months where a certificate of substantial completion has been issued. Such decision is final and binding upon both parties unless either the recommendation of a conciliator has been accepted by both parties and the decision of the engineer is revised by an arbitrator and an award has been made and published. Where the engineer has given his/her decision, or the time within which such decision has to be given has expired, either party, if dissatisfied with the engineer's decision or his/her failure to give such decision, may either give notice requiring the dispute to be considered under the ICE Conciliation Procedure, or may serve on the other party a 'Notice to Refer'. If conciliation is pursued, then the recommendation of the conciliator is deemed to have been accepted unless either party serves on the other a written notice to refer within one calendar month of its receipt. Where such notice is served, either party should serve on the other a written 'Notice to Concur' in the appointment of the arbitrator; and if the parties fail to appoint an arbitrator within the calendar month of the notice to concur either party may apply to the President of the ICE for him/her to make an appointment.



The ICE published a List of Arbitrators giving the names, details and brief curricula vitae of all those persons who have qualified with the institution as arbitrators. Such qualification is achieved, under current procedures, only after the candidate has qualified as an arbitrator with the Chartered Institute of Arbitrators; has satisfied the ICE, by passing a written examination (termed the 'Endorsement Examination') as to his/her knowledge of the ICE and other relevant forms of contract, and has attended and succeeded at an interview. By providing details of each arbitrator's qualifications and experience, both as an engineer and as an arbitrator, the ICE List of Arbitrators enables those seeking to appoint as arbitrator by agreement to check the suitability of a candidate's knowledge and experience.

### 7.3 The JCT Standard Form of Building Contract

The Standard Form of Building Contract, published by the Joint Contracts Tribunal, is currently in an edition dated 2005 and is commonly known as JCT2005. The form is published in six versions, covering all of the permutations of 'Local Authorities' or 'Private' with "With Quantities", 'Without Quantities', or 'With approximate Quantities'.

Section 9 of the form deals with the settlement of disputes by

- Mediation (clause 9.1) – The parties may, by agreement, seek to resolve any dispute or difference arising through mediation.
- Adjudication (clause 9.2) – If a dispute or difference arises under the contract which either party wishes to refer to adjudication, the adjudication scheme will apply. Adjudicator shall be the person (if any) and the nominating body shall be as stated in the Contract Particulars.
- Arbitration – Any arbitration shall be conducted in accordance with the JCT 2005 edition of the Construction Industry Model Arbitration Rules (CIMAR). Arbitration or legal proceedings are not an appeal against the decision of the Adjudicator but are a consideration of the dispute or difference as if no decision had been made by an Adjudicator.

Sub Clause 9.4.1 of that section includes a provision that written notice of a dispute may be given by one party to the other and that the dispute shall be referred to an arbitrator to be appointed. The arbitrator shall be an individual agreed by the Parties, failing such agreement within 14 days (or any agreed extension of that period) of the notice, appointed on the application of either Party by the person named in the Contract Particulars.

Provision is made in sub-clause 9.4.3 for referring disputes under related contracts concerned with substantially the same issues to the same arbitrator, and for empowering the arbitrator to order consolidation of the related disputes.

Clause 9.5 extends the powers of the arbitrators as follows: '... to rectify this Contract so that it accurately reflects the true agreement made by the Employer and the Contractor, to direct such measurements and / or valuations as may in his opinion be desirable in order to determine the rights of the Parties and to ascertain and award any sum which ought to have been the subject of or included in any certificate and to open up, review and revise any certificate, opinion, decision, requirement or notice and to determine all matters in dispute which shall be submitted to him in the same manner as if no such certificate, opinion, decision, requirement or notice has been given'.

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# Quantity Surveyor's Role in Project Management Team

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According to the mostly used definition, project management is the overall planning, controlling and co-ordination of a project from its inception to completion, aiming at meeting the client's requirements and ensuring completion on time, within the cost to the required quality standard.

The project manager is the person who is responsible for the success of the total project. They are identified in many different designations such as Project Coordinator or Team Leader depending on the organization structure. However, the main objective of the project manager should be ensuring the success of the project completion.

Attributes such as overall objectives, scope, risk, approach, budget, etc are vital in project management. The services of the modern quantity surveyors are sought through all of these process/phases of project management in representing financial and contractual interest of the project.

The main objectives of the Project Management Team in the construction industry can be classified as follows:

- a) Production of construction work which satisfies the client's functional requirements
- b) Completion of the project within specified cost limits
- c) Completion of the project within specified time limits
- d) Construction to specified standards
- e) Preservation of the health and safety of the people involved

In order to achieve the objectives given above the management team must exercise the functions of planning, procuring and controlling. Those functions will exist through all stages of the project. Therefore, services

of a quantity surveyor are very important in all the stages of a project.

The different stages of a construction project are as follows:

- a) Briefing Stage
- b) Designing Stage
- c) Tendering Stage
- d) Constructing Stage
- e) Commissioning Stage

The author hopes to discuss in brief the functions of the quantity surveyor (QS) within the Project Management Team, in a construction project at different stages.

During the briefing stage the QS gets his first opportunity to exhibit his ability and understanding of financial control of the project to the rest of the PM team with the preparation of preliminary budget estimates of the development using information obtained from historical cost data of a similar project carried out within a similar environment. At the same time it is QS's responsibility to provide an assessment of extra costs, if the client needs special features.

During the design developing stage the QS has to define clearly the cost of the value objectives of the client and identify ways in which they can be achieved. The QS involved in this stage can contribute to the project by giving advice on design economics, life cycle costing and in more depth, by extending the services to cost benefit analysis as well. Further in close liaison with the architect, QS will be able prepare a conceptual cost plans based on the client's brief, architect's concept design and specification notes. Also QS can make use of the cost information taken from the other similar recent projects. Preparation of early Cost Models for bench-marking of

the cost centers based upon historical cost data, for “Cost Planning” would be the next step for the QS.

After the design stage, prior to tendering, QS has to prepare tender documents including Bills of Quantities. The Project Management Team must obtain services and advices of the QS from time to time starting from the invitation of tenderers until the selection of the successful tenderer and award of the Contract.

The quantity surveyor's ability to demonstrate his understanding on contractual issues and documentation plays a vital role in the PM team as at this stage he/she is responsible for the selection of appropriate form of contract and method of measurements. The QS also should have a very comprehensive exposure to various procedures of tendering as his advises on such issues will always be sought by the PM team. The QSs possess a good ability to interpret specifications and standard correctly in the documents prepared by them. Their ability to analyze drawings and technical data accurately is also important in this documentation process. Selection of most appropriate procurement strategy for the development will play a key role in the success of the project and tender price. The QS's input on this vital decision is invaluable in the whole project management process.

Review and analysis of tenders submitted by tenderers are done by the Quantity Surveyor by analyzing those bids in terms of any calculation errors and more importantly identifying qualifications and assumptions made by the tenderers.

The Quantity Surveyor in the PM team should possess adequate knowledge of preparing cash flow forecasts relating to the agreed base line construction programme. Knowledge on various accounting systems is an added advantage for the QS in the PM team as they will act as links between site production team and the account staff.

The knowledge of law of contract of the QS would be an added value to the PM team. This may not be limited only to the law of contract but it would extend to law of tort, law of agency, arbitration, law of evidence etc. Moreover, the QS's input on settlement of disputes would have an added value to the PM team and for the whole development in particular.

The modern QSs in the Project Management environment are experts on preparation of various contractual claims, checking and verifying of merit and demerit of claims submitted by contractors and subsequently agreeing to the same. They also possess comprehensive knowledge on arbitration and alternative dispute resolution procedures.

During the stage of construction, formulation of a method of cost control is one of the very important tasks of a QS. Comparison of the actual cost with the predicted and analysed impact of the difference always helps to gain the successful control of the project.

Among the other functions of QS during this stage, can be listed as follows:

- Preparation and submission of interim valuation/ payment certificates of Contractors
- Preparation and submission of final statements/ payment certificates of Contractors
- Measurement of the works in accordance of Standard Methods
- Dealing with Variation/Change Orders including analysis of rates and prices of new/varied works
- Dealing with day-work and various types of contemporary site records
- Preparation of cash flow forecasts
- Cost Reporting
- Regular cost control meetings are intended to focus all parties' minds on cost management process, thereby preventing delays in the progress at the construction site, issuing and implementing various instructions.

Following competencies can be considered as special abilities of modern QS within the PM environment:

- Risk analysis
- Understanding health and safety issues at work
- Understanding of how to liaise with issues relating to planning and programming
- Liaising with KPI issues
- Quality assurance procedure
- Knowledge on supply chain management and procurement methods
- Knowledge on various legislation issues

# Cost Effectiveness and Functionality through Value Management in the Public and Private Sector – “A need of the hour”



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## Abstract

The concept of value management is still a relatively a new concept in Sri Lanka and is undoubtedly in the process of finding a niche in the construction industry. It is already being applied successfully in the construction industries in United States, Australia, Japan and in many other countries. Successful application of value management properly organized and executed identifies at the start of the project what gives value for money to achieve the project objectiveness in the most cost-effective way.

**Keywords:** Value management, structured approach value planning

## Introduction

There has been an enormous increase in the understanding and appreciation of the client's perception of value. This increase applies to the construction industry as well as to other industries. Value is a fundamental consideration for the client as it implies more than the initial cost or the lowest cost. In fact, it places cost within a framework of other value criteria (The Royal Institution of Chartered Surveyors, 1984), (Van Staden, 1991), (VM Services, 1992).

In addition to cost and value criteria, the criteria of functionality are addressed in value management. Value management can, therefore, make an important contribution by way of adding value to any service or projects. These can be in any sector to name a few such as Education, Manufacturing or Construction and any service orientated organizations. Value management comprises new techniques that are not yet as entrenched as those techniques related to financing, research, development and other administrative functions (May, 1994), McGeorge & Palmer, 1997), (Van Staden, 1991), (VM Services, 1992). The skills that the value manager has at his/her disposal is to apply these new techniques successfully to decrease any unnecessary cost and give value for money in any projects or services implemented with out cutting cost or quality.

In Sri-Lanka's context the country is in need of good management of government funds accountability, determine the priority projects for funding and stretch what is available, to give good value for money. Implementation of value management is the answer.

Value management seeks to eliminate unnecessary cost-cost which does not provide use, quality, performance or appearance and is in excess of client's requirement or need. Greater financial cost- effective solutions can be accomplished through value management than traditional cost reduction exercises. To achieve the maximum possible benefits properly facilitated value management should be initiated at the inception stage to the completion stage of any project.

Should quantity surveyors want to render a value management service, they ought to take cognisance of changing client requirements (The Royal Institution of Chartered Surveyors, 1984). Quantity surveyors shall have to become synonymous with the rendering of comprehensive cost and management services that are considered to be the sine qua non of ensuring “value for money” for their clients. To achieve this goal, the services rendered by quantity surveyors should be improved and extended. Kelly and Male (1988) state this position as follows:

‘The slow demise of the traditional functions of the quantity surveyor has led to a search for new opportunities ... provide a valuable insight into potential integration of value management into quantity surveying practice.’

## Skills profile of a value manager

The potential of quantity surveyors in South Africa, New Zealand, Australia and Sri Lanka to offer a value management service: “A comparative study was carried out by R.N. Visser Department of Construction Economics, University of Pretoria, Pretoria, South Africa, Chitra Weddikkara School

of Construction, Property and Planning, University of Western Sydney, Sydney, Australia and D. Thurnell School of Construction, UNITEC Institute of Technology, Auckland, New Zealand.

The ten key skills which are considered to be an essential part of the South African value manager's arsenal of competencies and which have already been identified in a previous study were used to compare the competency profiles of quantity surveyors in South Africa, New Zealand, Australia and Sri Lanka.

Following in-depth discussions with specialists in the field of psycho diagnostics, management consultancy and human resources and having considered a large variety of diagnostic instruments, it was decided to use the Potential Index Battery (PIB), a series of diagnostic instruments developed by Erasmus and Minnaar over a period of more than 20 years (Erasmus and Minnaar, 1996). Empirical research and experience have proved these instruments to be relatively culture free. The instruments used in this part of the investigation were provided through the courtesy of Potential Index Associates cc.

The battery of instruments comprises an extensive questionnaire, the Comprehensive Structured Interviewing for Potential (CSIP), in which 65 generic skills, that are present to a greater or lesser extent in any position, are briefly described. This list of skills was compiled with the assistance of the National Productivity Institute in South Africa and is directed at the identification of eight to ten skills which are key or critical components of a particular post. The list is generally submitted to a panel of five to eight specialists, who are familiar with the content and requirements of the post, with the instruction to identify the relevant eight to ten key skills.

To identify the key skills from the list, in this instance, a panel of assessors was selected from a population considered to be the most knowledgeable persons in value management in South Africa, and consisted of one expert from a facilitating company, three from the manufacturing industry, three from the construction industry and three quantity surveyors. The result of their assessment, accompanied by a brief definition of each skill, is set out (in rank order) hereunder:

- Creativity: The competency to develop new ideas and to create concepts and solutions to problems.
- Mental alertness: The competency to understand and appreciate new and often complex issues and concepts clearly.
- Leadership (Transformational): Channelling strategic

direction from the top; developing a clear vision of desirable conditions to provide direction in terms of action; building common ownership of commitment to group goals / a shared vision by involving team members in visioning, decision-making, problem-solving and management.

- Listening skills: The competency to listen and understand clearly and objectively what the real meaning/impact/importance is of verbally conveyed information.
- Conflict management/Collaboration: Conflict management – The extent to which the incumbent should reflect conflict management styles in initiating and managing acceptable solutions and outcomes to conflict solutions.  
Collaboration – Collaborate for a solution that is acceptable to both parties.
- Social style (Expressive): To be socially responsive; to think on one's feet; to reflect vision; to be able to put one's case verbally and to inspire; to be enthusiastic and to promote enthusiasm and spontaneity; to be very adaptable; to be open-minded.
- Innovation: Being open to the ideas of others; initiating change; improvising or modifying existing ideas and showing a willingness to experiment in order to ensure ongoing improvement.
- Adaptability: The competency to appreciate and consider other and often opposing views; to adapt to new ideas (change) when required.
- (Self-) motivation (Locus of control): The drive to achieve/persevere; to strive toward definite goals/ends; to take appropriate steps of his/her own record.
- Abstract reasoning: The competency to foresee/imagine/reason and to initiate workable and applicable concepts and conclusions through the application of imaginative ideas.

From the above listed ten skills, the ideal characteristics of a value manager were summarized with the assistance of Roode, of the organization Roode Personnel Evaluation (Pty) Ltd., as follows:

- The person can generally be described as someone who has above-average intellectual abilities; and is capable of thinking conceptually and of relating theoretical system and systemic variables in a holistic context. He/she will constantly want to see and understand the "larger picture" and will decidedly not get bogged down in insignificant detail.
- The thought patterns of the person concerned can be described as "lateral and creative". He/she will remain vigilant to identify the unexpected relationship between

elements. He/she therefore have to be acutely attuned to the external world; be open to the exceptional; and have an above-average directedness towards the behaviour and actions of other people and to any information that they may offer. When the expected does not occur, he/she will probably reveal a flexible attitude and be prepared to make adaptations, possible even taking a direction which he/she could no have foreseen.

- The source of his/her motivation will mainly be within himself/herself or – in psychological parlance – he/she will have an “internal locus of control”. This implies that he/she will consider himself/herself to be a person who should initiate action, maintain it and accept responsibility and liability if it does not take the desired course. Such a person can be functionally efficient without encouragement, praise, acceptance or bonus. External sources may exist, but his/her motivation mainly emanates from own satisfaction, values and needs. Consequently he/she is a “self-starter”.
- His/her thinking will be innovative and original. He/she will approach the possible solutions to problems constructively and as challenges and when he/she comes into conflict with others, he/she will mainly deal with it in a co-operative way (win/win). He/she will focus on the problem and its solution and not on the person, cause or result of the problem. When he/she fulfils a managerial function, his/her style will be sharply focused on “transformational”, in contrast to “transactional”, aspects. This implies that he/she will have a vision for the future, will know where he/she wants to take his/her organization, department or team and will know how to get them to identify with his/her vision and to get them to identify with it. He/she will, however, deal with the day-to-day operational aspects, but would rather delegate them and take charge of the matters that are important for leading his/her group from point A to point B in a visible way.

It is generally known that the skill to facilitate is probably the most important expertise that a successful value manager has. Although facilitation has not been included independently in the list of 65 generic skills, it is clear that the ability to facilitate is inextricable interwoven with all ten the identified key skills of the value manager.

## Competency profile

To answer the question of how quantity surveyors in South Africa, New Zealand, Australia and Sri Lanka match the ideal profile of a value manager and how they compare, the

following investigations were undertaken (Visser,1998) :

1. By using the measurement section of the PIB, the identified key skills were subjected to diagnostic evaluation. The PIB is available at various levels of complexity to provide for the widest possible spectrum of scholastic and cultural diversity. For the purposes of this investigation the advanced PIB and the extended PIB were used.

Because the ten identified key skills are probably unique to the individual concerned and not related to geographical region, and for practical reasons, only quantity surveyors in the Pretoria area in South Africa, Auckland in New Zealand, Sydney in Australia and Colombo in Sri Lanka were invited to participate in the empirical testing. The result of this investigation should therefore not differ to a statistically significant extent from the results that would have been obtained from a random sample of quantity surveyors drawn from a countrywide population.

The composition of the quantity surveyors which accepted the invitation to be tested in each country were as follows:

**South Africa:** Nineteen quantity surveyors, consisting of five woman and fourteen men.

**New Zealand:** Twelve quantity surveyors, consisting of twelve men.

**Australia:** Sixteen quantity surveyors, consisting of five woman and eleven men.

**Sri Lanka:** Fourteen quantity surveyors, consisting of two woman and twelve men.

The members of the selected panels were furthermore evenly spread in level of experience, ranging between twenty-four and sixty years of age.

The tests were taken on a specific day in one venue in each country. The results were analysed to determine whether the “average” quantity surveyor in each country could offer value management as a professional service and by doing so, identify the difference in the competency profile of the “average” quantity surveyor in the different countries (cf. table 1).

2. The members of the selected panel of quantity surveyors, who participated in the skills tests, were also requested to complete a questionnaire which contained a brief definition of each of the ten identified key skills. The instruction was firstly, to determine whether they consider themselves less so or more so than the “average” quantity surveyor and then decide whether



they are slightly, significantly or much less or more so. The purpose thereof was to determine the perception that quantity surveyors have of the level of their skills in respect of the ten key skills of a value manager (cf. table 2).

Table 2 indicates that the perception that quantity surveyors have of the average level of their own skills in respect of the ten key skills of a value manager, with the exception of Sri Lanka, is much higher than indicated by the summarized results of the structured skills tests (cf. table 1).

Table 1 indicates the results of the skills tests and should, however, be accorded a greater value because they are based on actual tests and not merely on perceptions. The method of testing, where applicable, and the comparative results are discussed hereinafter for each of the key skills.

- **Creativity**

**South Africa:** Scores ranged from 2,3 to 3,5 with a weighted average of 39%.

**New Zealand:** Scores ranged from 3,5 to 7,0 with a weighted average of 71%.

**Australia:** Scores ranged from 3,5 to 6,3 with a weighted average of 67%.

**Sri Lanka:** Scores ranged from 4,2 to 6,3 with a weighted average of 74%.

- **Mental alertness**

**South Africa:** Scores ranged from 2,3 to 4,7 with a weighted average of 53%.

**New Zealand:** Scores ranged from 2,8 to 7,0 with a weighted average of 80%.

**Australia:** Scores ranged from 4,2 to 5,6 with a weighted average of 76%.

**Sri Lanka:** Scores ranged from 2,8 to 7,0 with a weighted average of 74%.

- **Leadership: Transformational**

**South Africa:** Scores ranged from 1,2 to 3,7 with a weighted average of 35%.

**New Zealand:** Scores ranged from 0,1 to 3,1 with a weighted average of 33%.

**Australia:** Scores ranged from 0,4 to 3,8 with a weighted average of 29%.

**Sri Lanka:** Scores ranged from 0,4 to 3,1 with a

weighted average of 29%.

- **Listening skills**

**South Africa:** Scores ranged from 3,5 to 5,8 with a weighted average of 64%.

**New Zealand:** Scores ranged from 1,4 to 5,6 with a weighted average of 55%.

**Australia:** Scores ranged from 1,4 to 5,6 with a weighted average of 52%.

**Sri Lanka:** Scores ranged from 1,4 to 5,6 with a weighted average of 57%.

- **Conflict management: Collaborate**

The Roode Effective Conflict Resolution Test was used to obtain an indication of the preferential style of individuals in conflict situation as well as how effectively the style is applied. The test comprises 15 hypothetical conflict situations with a choice of five styles for each situation. These five choices are representative of the five recognised ways in which conflict can be resolved, namely competition, compromise, negotiation/co-operation, avoidance and accommodation.

If a person chooses the most appropriate style for a particular situation, a score of +2 is allocated to the response, +1 is allocated for an appropriate response in cases in which there is a better alternative, 0 for a neutral response that will not lead to seriously negative or positive outcomes, -1 for an inappropriate response where there is a poorer alternative and -2 for a totally inappropriate response. In this way the preference lists as well as the relative effectiveness thereof could be determined.

The square in the middle of the cube in figures 1 to 4 indicates the number of preferred choices that were expressed for each of the conflict management styles. It is clear that the negotiation style, with 125 and 84 choices, and the compromise style, with 47 and 31 choices respectively, are the two preferred styles for quantity surveyors in South Africa and New Zealand (cf. figures 1 and 2 respectively) and the negotiation style, with 112 and 79 choices, and avoidant style, with 45 and 34 choices respectively, are the two preferred styles for quantity surveyors in Australia and Sri Lanka (cf. figures 3 and 4 respectively). The square on the right-hand side indicates that the negotiation and compromise styles, with scores of respectively +56 and +60, +50 and +41, +51 and +39, and +48 and +30, were the most effective styles for all the quantity surveyors. The range of scores furthermore indicates that, except for South Africa, the negotiation style was chosen as

the most effective style. The left-hand square contains the number of ineffective choices and indicates that the competitive style for quantity surveyors in South Africa and Sri Lanka and the accommodative and avoidant styles for quantity surveyors in New Zealand and Australia respectively, run the greatest risk of being applied incorrectly and ineffectively.

It is therefore clear that if the “average” quantity surveyor has to deal with conflict, his or her preferred style will be collaborative and the co-operation/negotiation style will be applied the most successful as well. The strong effective application of the compromise style usually strengthens the potential effectiveness of a negotiation/co-operation approach and should be considered to be a positive element in the profile of the group of quantity surveyors that was tested. The overall average effectiveness on a scale of 0 to +30 is +8.2, +11.0, +8.0 and +6.8 respectively.

It must be noted that one quantity surveyor in Sri Lanka completed the test incorrectly and the test was therefore ignored.

- **Social style: Expressive**

The overall results indicate the social style of the quantity surveyors in terms of four categories, namely being an extrovert, a supporter, a driver and an analyser.

It can be deduced from figure 5 that the social style of the “average” quantity surveyor in the different countries is as follows:

**South Africa:** Very evenly divided between being a supporter (66 points out of a total of 190), a driver (65 points out of a total of 190) and an analyser (62 points out of a total of 190), while being an extrovert is a strong secondary style (45 points out of a total of 190).

**New Zealand:** Very strong being an analyst (41 points out of a total of 120) and evenly divided being a supporter (26 points out of a total of 120), an extrovert (22 points out of a total of 120) and a driver (19 points out of a total of 120) as secondary styles.

**Australia:** Very strong being a supporter (54 points out of a total of 160) and evenly divided being an analyst and an extrovert (32 points out of a total of 160 respectively) as secondary styles.

**Sri Lanka:** Very evenly divided between being a supporter (34 points out of a total of 140), an analyst (30 points out of a total of 140) and an extrovert (28 points out of a total of 140), while being a driver is a strong secondary style (21 points out of a total

of 140).

For practical reasons only the totals of the results have been summarized on the outside of the figure.

- **Innovation**

**South Africa:** Scores ranged from 1,4 to 7,0 with a weighted average of 69%.

**New Zealand :** Scores ranged from 3,8 to 4,1 with a weighted average of 57%.

**Australia :** Scores ranged from 3,8 to 4,2 with a weighted average of 57%.

**Sri Lanka:** Scores ranged from 3,5 to 4,2 with a weighted average of 56%.

- **Adaptability**

**South Africa:** Scores ranged from 1,2 to 5,8 with a weighted average of 42%.

**New Zealand :** Scores ranged from 2,8 to 5,6 with a weighted average of 67%.

**Australia:** Scores ranged from 1,4 to 5,6 with a weighted average of 57%.

**Sri Lanka:** Scores ranged from 2,8 to 7,0 with a weighted average of 57%.

- **(Self-) motivation**

**South Africa:** Scores ranged from 1,2 to 5,8 with a weighted average of 54%.

**New Zealand:** Scores ranged from 4,2 to 5,6 with a weighted average of 65%.

**Australia:** Scores ranged from 1,4 to 6,3 with a weighted average of 68%.

**Sri Lanka:** Scores ranged from 3,5 to 6,3 with a weighted average of 62%.

- **Abstract reasoning**

**South Africa:** Scores ranged from 2,3 to 5,8 with a weighted average of 63%.

**New Zealand:** Scores ranged from 2,8 to 5,6 with a weighted average of 60%.

**Australia:** Scores ranged from 1,4 to 5,6 with a weighted average of 51%.

**Sri Lanka:** Scores ranged from 1,4 to 5,6 with a weighted average of 53%.

## Summary

The abovementioned results indicate that when the skills profile of quantity surveyors is matched against that of the

key skills required for value management, their skills profile is generally found to be average in South Africa and between average and above average in New Zealand, Australia and Sri Lanka.

It should, however, be borne in mind that the results are based on an average and that there were individual quantity surveyors whose skills profile closely matched the defined profile for a value manager.

## Conclusion

On the basis of the above results it can be stated that the extent of the match between the skills profile of the quantity surveyor and that for a value manager is between average and above average, but that, as a result of their background and training, some quantity surveyors do have the potential to be a successful value manager.

Quantity surveyors do have the opportunity to acquire the technique of value management and the required skills to enable them to render a value service to clients.

Further research can be done by awarding certain weighting values to the key skills in order to test and compare quantity surveyors with each other and to broaden the study to include other professionals in the construction industry such as architects, engineers and construction managers.

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Skills	SA	NZ	AUS	SL
Creativity	2.7631	4.9583	4.6813	5.1500
Mental alertness	3.6842	5.6000	5.3375	5.2000
Leadership : Transformational	2.4608	2.2750	2.0563	2.0400
Listening skills	4.4825	3.8182	3.6400	3.9846
Conflict management : Collaborate	*	*	*	*
Social style : Expressive	*	*	*	*
Innovation	4.8632	3.9783	3.9813	3.9300
Adaptability	2.9474	4.6667	4.0000	3.9846
Self-motivation	3.7456	4.5500	4.7250	4.3500
Abstract reasoning	4.4211	4.2000	3.5875	3.7000
<b>Total average</b>	<b>3.6710</b>	<b>4.2558</b>	<b>4.0011</b>	<b>4.0424</b>
Key: SA - South Africa (19 QS)      NZ - New Zealand (12 QS) AUS - Australia (16 QS)      SL - Sri Lanka (14 QS) Averages (Scale 1-7): Structured skills tests      * - Average not calculable				

Table 1 : Competency profile of quantity surveyors (Structured skills tests) : Key skills of the value manager

Skills	SA	NZ	AUS	SL
Creativity	5.1579	5.0833	5.5000	3.7143
Mental alertness	5.3158	5.3333	5.4375	4.9286
Leadership : Transformational	4.6667	5.0833	5.1875	4.5000
Listening skills	4.4737	5.7500	5.0000	3.8571
Conflict management : Collaborate	5.1053	5.0833	5.0625	4.2857
Social style : Expressive	5.2105	5.0000	5.1250	4.1429
Innovation	5.2632	5.1667	5.5000	4.2857
Adaptability	5.1053	5.0833	5.6250	3.9286
Self-motivation	5.6842	5.6667	5.6250	4.1429
Abstract reasoning	5.0526	5.1667	5.6250	4.2857
<b>Total average</b>	<b>5.1036</b>	<b>5.3916</b>	<b>5.3688</b>	<b>4.2072</b>
Key: SA - South Africa (19 QS)      NZ - New Zealand (12 QS) AUS - Australia (16 QS)      SL - Sri Lanka (14 QS) Averages (Scale 1-7): Questionnaire				

Table 2 : Competency profile of quantity surveyors (Questionnaire) : Key skills of the value manager

## Roode: Effective Conflict Resolution Index

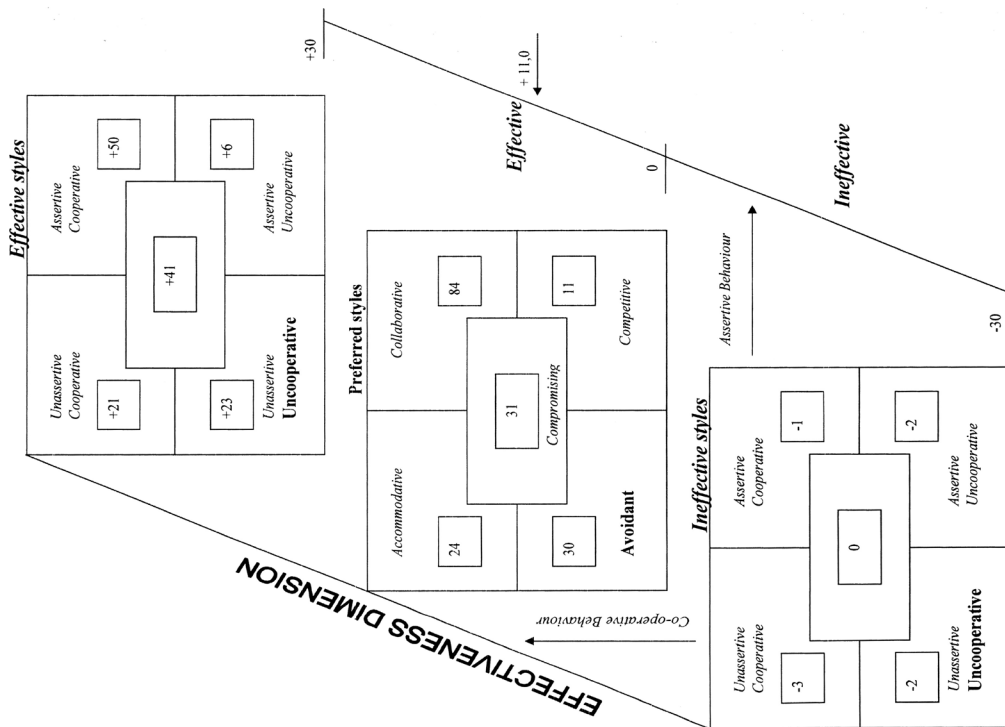


Figure 2: New Zealand (NZ) – Effective conflict resolution index of quantity surveys

## Roode: Effective Conflict Resolution Index

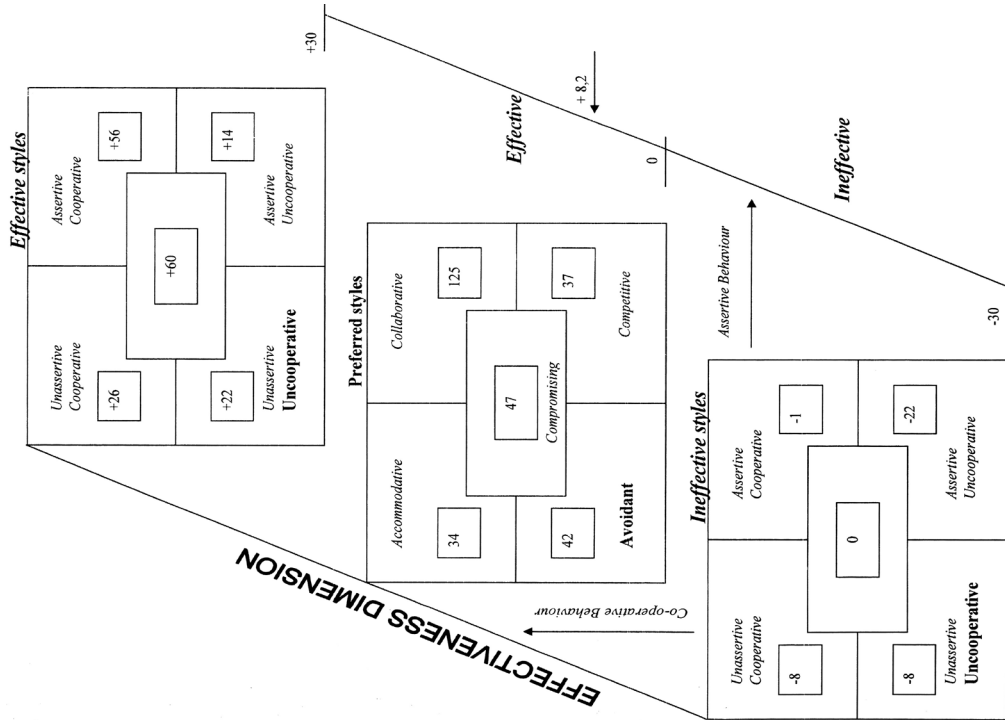


Figure 1: South Africa (SA) – Effective conflict resolution index of quantity surveys

## Roode: Effective Conflict Resolution Index

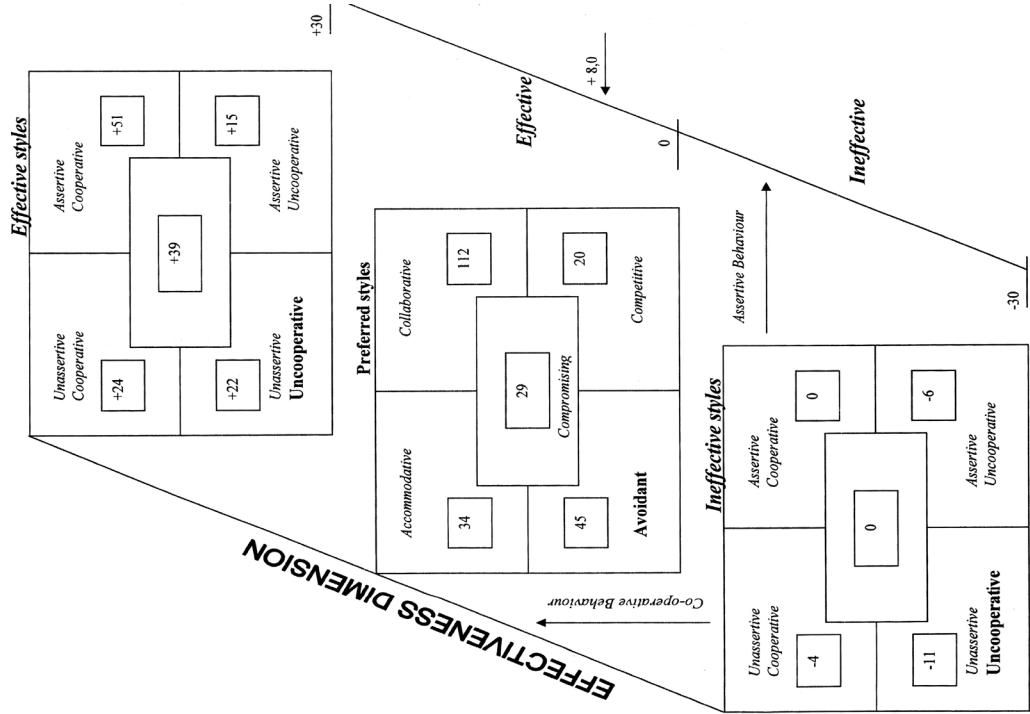


Figure 3: Australia (AUS) – Effective conflict resolution index of quantity surveys

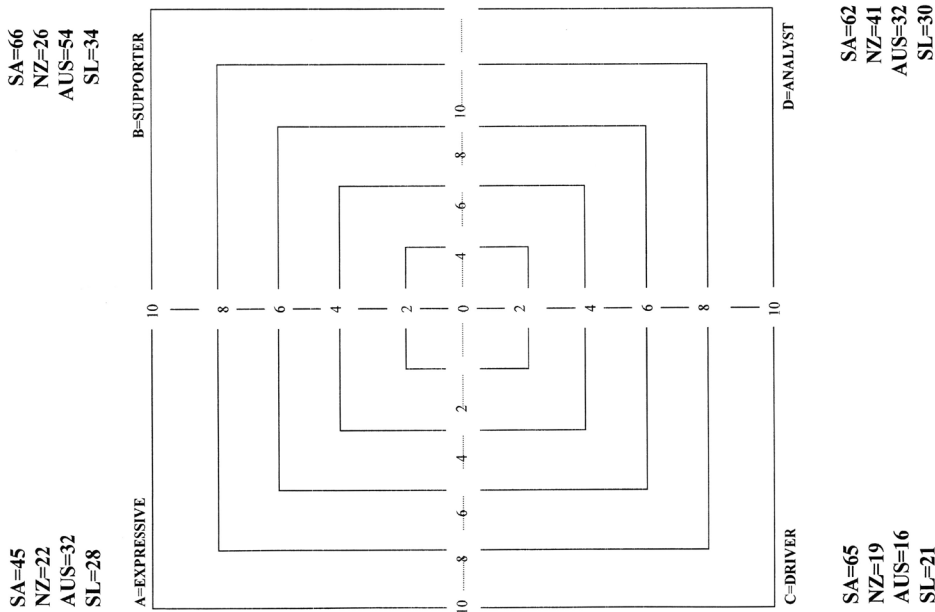


Figure 5: Social style of quantity surveys



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