

CHAPTER 2: LITERATURE REVIEW

2.1 Background

The universal objective of construction projects is to complete the project on time and within the budget while meeting established quality requirements and other specifications. The increasing complexity of infrastructure projects and the environment within which they are constructed place greater demands on construction managers to deliver projects on time with budget and high quality (Enshassi, Al-Najjar and Kumaraswamy 2009)

As a client organization, the RDA taking the risk that projects will not get built on schedule, that those will not get built for what has budgeted, and that those will not be of the quality expected.

As mentioned in the PMBOK (Project Management Institute 2004) project risk has its origins in the uncertainty that is present in all projects. Known risks are those that have been identified and analyzed, and it may be possible to plan for those risks using the processes of project management. However, unknown risks are not that easy to avoid, cannot be managed proactively and a prudent response by the project team can allocate general contingency against such risks, as well as against any known risks for which it may not be cost effective or possible to develop a proactive response.

A research study has been done to identify the key factors that lead to cost overrun in foreign funded road and bridge projects of Sri Lanka, utilizing the documentary records available in the RDA (Nawfal 1997).

The key factors are,

- Price fluctuation
- Currency fluctuation
- Claims
- Variation orders
- Dispute Settlement awards
- Compensation and cost arising from increase in quantities.

In addition to the above key factors, it has found 23 principal common causes of claims in RDA contracts of foreign funded projects.

1. Inadequate time provision to prepare tender documents.
2. Incomplete work descriptions
3. Inadequate site investigation
4. Inadequate contract documents
5. Post tender correspondence and negotiation
6. Cost of testing
7. Bore hole and exploratory excavation
8. Delays in the relocation of services
9. Delays in land acquisition
10. Lack of co-ordination with other organizations.
11. Lack of knowledge in interpretation of terms of the contracts
12. Delays in providing facilities for the engineers
13. Late issue of drawings and instruments
14. Missing setting out details
15. Delays in advance payments
16. Late issue of interim certificate
17. Late payment of certificates
18. Inadequate contract monitoring and management.
19. Civil disruptions
20. Delays in locating suitable naturally occurring material
21. Effect of subsequent legislation
22. Inherent characteristics of contractor
23. Mismanagement of advance payment

Risk factors identified, which lead to cost overrun have been categorized as follows
(Dada and Jagboro 2007)

1. Physical risk factors
2. Environmental risk factors
3. Design risk factors
4. Logistics risk factors

5. Financial risk factors
6. Legal risk factors
7. Political risk factors
8. Operational risk factors
9. Time schedule slippage

However, the main risk factors identified are financial and political influence among the above. Here a model has developed by relating the variation between the initial contract estimate and the actual project cost to the risk variables. From the analysis, the percentages of project cost overrun due to the impact of risk were established for each procurement method investigated (Table 2). The research recommends that contingency addition should be equal to the cost overrun amount, since the objective of contingency allocation is to excessive expenditure coverage.

Table 2 : Contingency percentages for different procurement method

Procurement Method	Contingency %
Management Procurement Method	30 %
Traditional Method	16 %
Design and Build	9 %
Management Construction	25 %
Direct Labour	13 %

Hence, for the Nigerian construction industry, a 16% contingency allocation is recommended, since cost overrun factors coincide with contingency risk factors, as identified by the researcher.

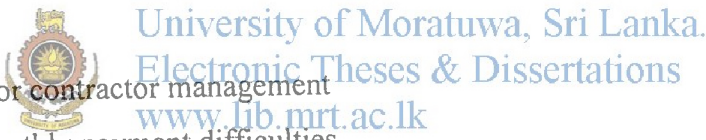
Delays and cost increases in the construction of private residential projects in Kuwait has been studied (Koushki 2005). The amount of time delays and cost increases was greater when the total cost of a residential project was higher. A major factor

contributing to the time and cost increase was the inadequacy of money and time allocated to the design phase.

However the three main cases for above cost overrun were

1. Poor contract management ,
2. Material related problems
3. Owners' financial constraints.

26 factors have been identified that cause cost overruns in construction of ground water projects in Ghana (Frimpong 2003). According to the contractors and consultants, monthly payments difficulties was the most important cost overruns factor, while owners ranked poor contractor management as the most important factor. Despite some difference in viewpoints among the three groups surveyed, there is a high degree of agreement among them with respect to their ranking of the factors. The overall ranking results indicate that the three groups felt that the major factors that can cause excessive ground water project cost overruns in developing countries are

- 
1. Poor contractor management
 2. Monthly payment difficulties
 3. Material Procurement
 4. Poor technical performances and
 5. Escalation of material prices

It has studied the factors influencing construction time and cost overruns for high rise projects in Indonesia (Kaming 1997) where 31 project managers working in high rise buildings were surveyed and pointed out that the major factors influencing cost overrun were

1. material cost increase due to inflation
2. Inaccurate material estimating and
3. Degree of project complexity

The main cost overrun factors identified for construction projects in the Gaza Strip (Enshassi, Al-Najjar and Kumaraswamy 2009) are

1. Increment of material prices due to continuous border closures
2. Delay in construction, supply of raw materials and equipment by contractors
3. Fluctuations in the cost of building materials
4. Project materials monopoly by some suppliers
5. Unsettlement of the local currency in relation to dollar value
6. Low commitment of donor to compensate any bad result that may come from the bad economic and political situation
7. Donor policy in bidding tender to the lowest price one
8. Design changes
9. Extra works at owners request
10. Resource constraint
11. Funds and associated auxiliaries not being ready
12. Lack of cost planning monitoring during pre and post contract stages
13. Improvements to standard drawings during construction stage
14. Inadequate review for drawings and contract documents
15. Contractual claims such as extension of time with cost claims
16. Inaccurate quantity take off
17. Technical incompetence, poor organizational structure and failures of the enterprise
18. Lack of cost reports during construction stage
19. Inadequate project preparation planning and implementation
20. Delays in issuing information to the contractor during construction stage
21. Lack of co-ordination at design phase
22. Change in the scope of the project, in government policies
23. Some tendering manoeuvres by contractors, such as front loading of rates
24. Incomplete design at the time of tender
25. Bad allocation of labour inside the site
26. Delays in decision making by government, failure of specific co-ordinating
27. Delay in costing variations and additional works
28. Lack of experience of project type

29. Re measurement of provisional works
30. Wrong/Inappropriate choice of site
31. Omissions and errors in the bills of quantities
32. Delay in handing over of projects
33. Absence of managerial programs that help in saving materials inside the site
34. Indecision by the supervising team in dealing with the contractors queries resulting in delays
35. Lack of experience of local regulation
36. Change in owner's brief
37. Inability of the contractor to adopted properly to the project environment
38. Labour unrest
39. Lack of attracting skilful technicians for work
40. Lack of experience of technical consultants, inadequacy of foreign collaboration agreements, monopoly of technology
41. Unpredictable weather conditions
42. Long period of the project maintenance period
43. Over time work hours of supervising engineer are paid by the engineer.



University of Moratuwa, Sri Lanka
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

The magnitude of average schedule slippage due to variations was reported as 18% (Kumaraswamy, Millar D and Yogeswaran 1998). The deviation (variation) cost amounted to an average of 14% of the total cost of the project (Zeitoun and Oberlender 1993). Although there have been cases where variation cost accounted for as high as 100% of the budgeted funds, the industry norm was about 10%. The impact of variations varies from one project to another. However it is generally accepted that variations can affect construction projects with unpalatable consequences in time and cost (Hester, Kuruprenas and Chang 1991).

2.2 Risk Management

As per the PMBOK guide, project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses and monitoring and control of a project. Most of these processes are updated throughout

the project. The objectives of risk management are to increase the probability and impact of positive events and decrease the probability and impact of events adverse to the project.

The project risk management processes include the following.

1. Risk Management Planning
2. Risk Identification
3. Qualitative Risk Analysis
4. Quantitative Risk Analysis
5. Risk Response Planning
6. Risk Monitoring and Control

2.3 Contingency Budget

The purpose of the project contingency allocation is to generate a reserve of funds sufficient to assure successful completion of the project on time and within total budget through minimization of the cost overrun risk factors.

The contingency sum, usually expressed as a percentage mark-up on the base estimate, is used in an attempt to allow for the unexpected. Construction and development is fraught with difficulty, and the basic notion of risk analysis is that it is useful to at least make an attempt to identify these risky items and attach some financial value to them.

These amounts can then be added to a project budget as items of possible expenditure. The intention is that project budget becomes a more realistic representation of the client's likely outlay.

However, there are several weaknesses inherent in using a contingency amount as per the (Thompson and Perry 1992)

The percentage figure is, most likely, arbitrarily arrived at and not appropriate for the specific project.

- There is a tendency to double – count risk because some estimators are inclined to include contingencies in their best estimate.

- A percentage addition still results in a single figure prediction of estimated cost, implying a degree of certainty that is simply not justified.
- The percentage added indicates the potential for detrimental or downside risk, it does not indicate any potential for cost reduction, and may therefore hide poor management of the execution of the project.
- Because the percentage allows for all risk in terms of a cost contingency, it tends to direct attention away from time performance and quality risks.
- It does not encourage creativity in estimating practice, allowing it to become routine and mundane, which can propagate over sights.

2.4 National Procurement Agency Guidelines

These guide lines provide instruction of contingency amount allocations on GOSL funded projects. The relevant clauses are as follows.

Variation Orders – Works

Clause 8.13.1



University of Moratuwa, Sri Lanka.

Electronic Theses & Dissertations

www.lib.mrt.ac.lk

The condition of contract will normally empower the employer to vary the form, quality or quantity of the work to be executed at any time during the progress of the work and provide the basis for such variation and valuation of such variations within approved limits.

Clause 8.13.2

A contract variation order is used to obtain approval to order variations and, more particularly to obtain authorization to incur the financial effects of them.

Approving Authority for Aggregate Variations not exceeding the Contingency Provision (Clause 8.13.3)

Contract variation orders may be authorized by the Head of Department/Project Director provided that the net sum of the variation and any previous variation does not exceed the amount of the contingency provision provided in the approved contract budget. Contingency provision generally should not exceed ten percent (10%) of the estimated contract amount.

Approving Authority when Contingency provision is exceeded (Clause 8.13.4)

When the approved contingency provision is exceeded or where there is no contingency provision, the contract variation order should be submitted for approval to the appropriate level of authority given in the Procurement Manual.

2.5 National Procurement Agency Procurement Manual

Corresponding reference of Procurement Manual, 2006 on Variation to Contracts is as follows.



University of Moratuwa, Sri Lanka
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

Clause 8.13.4

The variation to contracts during the implementation stage causes a very high burden on the Procurement Entity and the Government. If the contribution from the variation to the final contract sum is high it will dilute the procurement process that was carried out when awarding the contract.

Therefore the procurement entity must ensure that all professional and human efforts are taken to minimize this situation. Variations are mainly due to change of scope and quantity variations.

To minimise variations due to change of scope, the procurement entity should get a comprehensive briefing from the persons who are involved in design, whether they are internal or external consultants before inviting bids. In case the aggregate

variation exceeds the contingency amount, and the procurement entity requires approval for the varied amount, the procurement entity is required to certify that the contract award or the persons who have involved in design would have foreseen. In the latter case the approving authority may require to obtain a statement from such persons and procurement entity must forward the same.

To minimize variations due to inaccurate quantities or omissions in the BOQ, it is recommended that before the start of preparation of bidding documents, PE should obtain a certificate from the persons who have prepared the BOQ that a second person has checked the BOQ for its accuracy and completeness.

Despite all above, if the aggregate amount of the variations (due to quantity changes and extra works orders issued), is within the contingency provision (which should be 10% maximum) the HD/PD may approve the change order.

Otherwise, the HD/PD should take necessary steps to revise the TCE.

If the aggregate amount of variation as computed above is still within the 5% limit of the original TCE, the CAO, if he is satisfied with the variation and by obtaining the assistance of a TEC appointed by him may approve the variation.

If the aggregate amount of variation as computed above is more than or equal to 5% of the original TCE, and if the CAO is satisfied with the variation, the variation should be approved by the appropriate PC assisted by the appropriate TEC. For this purpose the appropriate committees should decide on the basis of revised TCE and not necessarily the committees that handled the original procurement.

2.6 Practice of the Road Development Authority

Taking the Sri Lanka road and bridge construction industry, the RDA handles most of such contracts as the client on behalf of the government. Under the RDA, in addition to government funding, various types of donor agencies are operating such as, the Asian Development Bank (ADB), World Bank (WB), Overseas Economic Corporate Fund (OECF), Japanese Funding Agency (JAICA), Kuwait Funding (KF) etc.

Government funds are received by the RDA from the yearly allocation by the Government for rehabilitation and construction of national roads and bridges in Sri Lanka. These funds are released considering the requirement of the 10 provinces operating under the Provincial Directors. At the provincial set up, the Director Maintenance, Management and Construction distributes the allocation to each Provincial Director and thereafter the Provincial Director will allocate the received funds to the respective Chief Engineers of the district under him, and Chief Engineers will distribute received allocation to the respective Executive Engineers of the division and project engineers.

While commencing construction work, if the construction cost exceeds the original contract amount, while being within the contingency allocation, then the Director MMC can approve to continue the works with the excess amount through the Provincial Director.

In addition to that, if the prevailing excessive amount is greater than the contingency portion, but less than 10% of original contract amount, then it should get the approval of the Director General, through the Director MMC, Sri Lanka. Further, if the excess amount within 10% to 15%, then the Secretary of the Ministry of Highways can approve it. (Either through MPC assisted by TEC or without MPC)

In addition to that, if the prevailing excessive amount is greater than 15% of original contract amount, then it should get approval through MPC assisted by a TEC.

2.7 Variations

Variations are the major component which contributes to the contingency budget of RDA road and bridge projects.

A variation is any deviation from an agreed well defined scope and schedule. Stated differently, this is a change in any modification to the contractual guidance provided to the contractor by the owner or owner's representative. This includes changes to plans, specifications or any other contract documents. Variations in construction projects can cause substantial adjustment to the contract duration, total direct or

indirect cost or both. The magnitude of average schedule slippage due to variations was reported as 18% (Kumaraswamy, Millar D and Yogeswaran 1998) the deviation (variation) cost amounted to an average of 14% of the total cost of the project (Zeitoun and Oberlender 1993). Although there have been cases where the variation cost accounted for as high as 100% of the budgeted funds, the industry norm was about 10%. The impact of variations varies from one project to another. However, it is generally accepted that variations can affect construction projects with unpalatable consequences in time and cost (Hester, Kuruprenas and Chang 1991).

2.8 Condition of Contract for Cost Control

In addition to the procurement guide lines and procurement manual published by the NPA, for Rs.10 – 100 million GOSL funded projects should follow the guidance and instructions of Standard Bidding Document 1, published by ICTAD.

The Condition of Contract (SBD1 2007) was studied in detail to identify cost exceedance situations. The relevant clauses most likely to give rise to the cost claims were as follows.



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

Clause 37 Bills of Quantities

37.1 The bills of quantities shall contain items for construction installation, testing, and commissioning work to be done by the contractor

37.2 The bill of quantities is used to calculate the initial contract price. The contractor is paid for the quantity of the work done at the rate specified in the bills of quantities for each item.

Clause 38 Changes in the Quantities

38.1 If the final quantity of the work done differs from the quantity in the BOQ for the particular item by more than 25% , provided the change exceeds 1% of the initial

contract price , the engineer shall re examine the rate based on market conditions and adjust the rate to allow for the changed quantity exceeding the 25%.

38.2 The engineer shall not adjust rates arising from changes in quantities if thereby the initial contract price is exceeded except the prior approval of the employer.

38.3 If requested by the engineer, the contractor shall provide the engineer with a detailed cost breakdown of any rate in the BOQ.

Clause 39 Variations

39.1 Variations may be initiated b the engineer at any time prior to issuing the certificate of completion for the works, either by an instruction or by a request for the contractor to submit a proposal.

39.2 Variation may be ordered by the engineer provided the cumulative value of all such variations issued does not exceed a sum specified in the contract data. Any variation ordered above this limit would need the prior approval of the employer.

39.3 The contractor shall execute and be bound by each variation, unless the contractor promptly gives notice to the engineer with supporting documents to establish that he cannot obtain the necessary equipment, materials, plant & temporary works or any of them as appropriate, require for the variation. Upon receiving this notice, the engineer shall reconfirm, vary or cancel the instruction.

39.4 Each variation may include:

- a) Changes to the quantities of an item of work included in the contract
- b) Changes to the quality and other characteristics of any item of work
- c) Changes to the levels, positions and dimensions of any part of the works
- d) Omissions of any work other than work intended to be carried out by others.
- e) Any additional work , plant, material or services necessary for the works including any associate tests on completion, boreholes and other testing and exploratory work: or



39.5 The contractor shall not make any alteration and /or modification of the permanent works, unless and until the engineer instructs or approves a variation.

39.6 All variations shall be included in updated programmes produced by the contractor.

Clause 40 Payment for Variations

40.1 The contractor shall provide the engineer with a quoted for carrying out the variation when requested to do so by the engineer within 07 days or such extended time given by the engineer. The engineer shall assess the quotation before the variation is ordered, taking in to consideration the provision given in the contract data.

Clause 43 Payments

43.1 Payments shall be adjusted for deductions for advance payments and retention. The employer shall pay the contractor the amounts certified by the engineer within 14 days of the date of each certificate. If the employer makes a late payment the contractor shall be paid interest on the late payment in the next payment. Interest shall be calculated from the date when the late payment is made at the prevailing rate of interest of 1% over the lending rate of the central bank to commercial banks.

43.2 If an amount certified is increased in a later certificate or as a result of a recommendation by the adjudicator or an arbitrator, the contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

43.3 Unless otherwise stated, all payments and deductions will be paid in Sri Lanka Rupees.

43.4 Items of the works for which no rate or price has been entered in will not be paid for by the employer and shall be deemed covered by other rates and prices in the contract.

Clause 44 Compensation Events

44.1 The followings are the compensation events.

- a. The employer does not give access to a part of the site by the site possession date stated in the contract data.
- b. The employer modifies the schedule of other contractors in a way that affects the work of the contractor under the contract.
- c. Other contractors, public authorities, utilities, or the employer does not work within the dates and other constraints stated in the contract, and they cause delay or extra cost to the contractor.
- d. The engineer orders a delay or does not issue drawings, specifications or instructions required for execution of the works on time.
- e. Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the letter of acceptance from the information issued to bidders (including the site investigation reports), from information available publicly and from a visual inspection of the site.
- f. The engineer gives an instruction for dealing with an unforeseen condition, caused by the employer or additional work required for safety or other reasons.
- g. The advance payment is delayed.
- h. The effects of the contractor of any of the employer's risks.
- i. The engineer unreasonably delays issuing a certificate of completion.
- j. The engineer instructs the contractor to uncover or to carry-out additional tests upon work, which is then found to have no defects.
- k. Other compensation events described in the contract or determined by the engineer shall apply.

44.2 If a compensation event would cause additional cost or would prevent the work being completed before the intended completion date, the contract price shall be increased and/or the intended completion date shall be

extended. The engineer shall decide whether and by how much the contract price shall be increased and whether and by how much the intended completion date shall be extended.



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk