

# COMPREHENSIVE STUDY ABOUT SRI LANKAN CONTRACTORS' ESTIMATION PRACTICE

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## ABSTRACT

*The “estimating process” is a significant element within the circle of construction due to the lack of financial resources available. Tender cost estimating in Sri Lankan construction industry requires extensive knowledge and expertise. This research proposed a best estimation practice to the Sri Lankan construction industry. This study expects it will fulfil the research gap and uplift the Sri Lankan contractors’ current estimation practice. The aim of this research is to suggest solutions to address the limitations of current estimating practice prevailing in the Sri Lankan construction industry comparing to the proposed best estimation practice. This research has been conducted through literature reviews, questionnaire survey and interviews. The questionnaire included sixteen steps identified as the best estimation practice through literature review and interviews, with a view to find out the current estimation practice of Sri Lankan contractors. The analysis of data revealed although they are following all sixteen steps, they couldn’t able to gain the maximum benefit of those steps owing to some limitations. Therefore in order to find out the solutions for those limitations Seventeen interviews were carried out. Among those, nine interviews were from contractors and eight interviews were from consultants.*

*These conclude that limitations and solutions identified by the contractors were similar with those identified by the consultants. In the comparison of their opinions the degree of agreement on most of the factors between them is high. It shows consultants’ understanding about contractors’ works are quite high.*

*The study recommended that both contractors and consultants give more attention to the cost estimating process to manage the projects in a better way and to hire qualified technical staff in order to obtain an accurate estimate. Contractors were requested to keep databases and to make relevant changes and modifications in their existing estimating practices in their future projects.*

**Keywords:** Accuracy; Consultants; Contractor; Tender Cost Estimation.

## 1. INTRODUCTION

The construction industry is usually considered to be the backbone in any economy, as it absorbs a relatively high percentage of the national workforce (Enshassi *et al.*,2010). Construction industry has its own characteristics that distinguish it from other sectors of the economy (Nega, 2008). Estimating is a technical process of predicting the cost of construction project (Chartered Institute of Building, 1997). Within the sphere of construction, the “estimating process” is a significant due to the lack of financial resources available (Britto, 2013). Comprehensiveness of the cost estimation process varies in terms of availability of information, nature of the project, available time duration for estimation and structural constituents (Shashand Ibrahim, 2005). Tender documentation includes drawings, specifications, conditions of contract, and bills of quantities which are used in preparation of cost estimate (Akintoye, 2000). Further, Akintoye (2000) stated that the estimating department undertakes various tasks in collaboration with other departments within the company to arrive at the consolidated net cost estimate for the project. Thus, contractors have to follow systematic process for performing cost estimation. The cost estimation process includes study the tender documents, prepare tender time table, visit to site and consultant, enquiries and quotations analysis, prepare the method statement and programme for the

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project, design temporary works, arrange mid tender review meeting, build up rates, price preliminaries, adjustments for price fluctuations, prepare cash flow, add overhead and profit and prepare bill of quantities (Chartered Institute of Building, 1997). The combination of mentioned process is named as estimation practice.

The best estimation practices are not only about predicting the cost of construction, but also it consist of several uses as control and monitor project execution, audit project success, preparation of tender, schedule of labour, material and plant, make decision to tender and select project to be tendered (Nagulan, 2001). Application of best estimation practices helps to ensure a high-quality estimate, certain best practices, should be followed if accurate and credible cost estimates are to be developed (Ahmad *et al.*,2012). These best practices represent an overall process of established and repeatable methods that result in high-quality cost estimates that are comprehensive and accurate and that can be easily and clearly traced, replicated, and updated (Brook, 2004). An understanding of cost estimating issues and considerations would make estimating an effective component of overall cost and project management (Michael, 2003). Therefore, implementing good estimating practices make it possible to improve planning and budgeting accuracy, resulting in the delivery of quality projects within shorter time frames.

Britto (2013) discovered that the existing estimating practices in Sri Lanka are not effective for the future, as the Sri Lankan construction industry isn't practicing the best practices as well as they are following the traditional practices. Further, accuracy of the estimate via these practices is not highly satisfactory. Therefore, previous studies signposted the indispensable need for the best estimating practices for the cost estimating in Sri Lanka. Abeyasinghe (2006) recommended that it will be enormously benefited to have a review on cost estimating practice in terms of education and training. According to existing literature related to this research area, Sri Lankan construction industry operates without a proper and systematic estimation practice.

Sri Lankan contractors believe that ensuring accuracy of cost estimating does not much influence the probability of winning the job compared with determining the suitable markup. The decision level management takes greater care in markup decisions rather than the other cost estimation (Nagulan, 2001). This seems that the estimators are not encouraged to follow best estimation practices in proper manner by management. Thus, there is a necessity for establishing the best estimation practice in Sri Lankan construction industry.

In the Sri Lankan context many researches have been conducted on "Construction Estimates" as a whole (Sumanasingha, 2010). A few researches have been carried out to investigate regarding the estimation practices of Sri Lankan contractors and construction industry but they were unable to find out the current contractor estimation practices of the Sri Lankan contractors and its limitations. Thus, there is a necessity to fill this potential research gap. Hence, this study is focused to identify the solutions to address the limitations of current estimation practice used by Sri Lankan contractors.

Therefore this research aimed to suggest solutions to address the limitations of current estimating practice prevailing in the Sri Lankan construction industry comparing to the best estimation practice. Fulfilling the above research aim was done by achieving four research objectives. These objectives are; (1) Propose the best contractors' estimation practice (2) Identify the current estimation practice used by the contractors in Sri Lanka, (3) Find out the limitations of current estimation practices of Sri Lankan contractors by comparing with the proposed best estimation practice, (4) Propose the enhancement solutions for the identified limitations of the current estimation practices used by contractors in Sri Lanka.

## **2. LITERATURE REVIEW**

### **2.1. IMPORTANCE AND PURPOSE OF PROPER ESTIMATING PRACTICE**

It is found that uniform guidance on cost estimating practices and procedures that would be the basis for formulating valid, consistent, and comparable estimates was lacking within the Sri Lankan construction Industry (Britto, 2013). 'Best Practice' in cost estimation from project identification phase through to project delivery and implementation leads to efficient use of scarce public resources and mitigates the risk of cost overruns. Better cost estimation also provides higher levels of certainty for public sector

organisations, governments and the public to whom government agencies are accountable (Department of Infrastructure, Transport, Regional Development and Local Government of Australia, 2008). Cost overrun is a chronic problem across most projects. While a significant research have been published on this topic, the understanding of the root causes and a clear direction towards improvement remained unexplored. The focus of the past research is mainly on the factors directly or indirectly associated with the project environment and their relative impact on overall cost performance in projects. The resulting concept model on cost overrun was unable to fill a significant knowledge gap in cost estimation practice across all industry sectors (Doloi, 2011). While numerous models and methodologies have been developed over past years on dealing with the cost estimation and managing escalations in projects, there is still a significant knowledge gap emerging in establishing a reference or base model for improving the estimating practices across the industry (Ahmad *et al.*, 2012).

Basic characteristics of credible cost estimates through the proper cost estimation practices are defined as; Clear identification of task, Broad participation in preparing estimates, Availability of valid data, Standardised structure for the estimate, Provision for programme uncertainties. The existing literature revealed that there is a need for developing the best practice cost estimation standard as a document that could be a benchmark for contractors to measure themselves against (Department of Energy, 2011).

The estimating department, while preparing the cost estimate takes an overall view of the project and considers factors that may have an impact on estimating and pricing for the project, including production performance anticipated during the construction stage (Chartered Institute of Building, 1997). In the study of Akintoye (2000) the initial analysis of the 24 factors were considered and the study shows that the main factors relevant to cost estimating practice are complexity of the project, scale and scope of construction, market conditions, method of construction, site constraints, client' s financial position, buildability and location of the project. The practice of cost estimating does not differ from conventional techniques based on the use of labour and material constants to obtain prices for bills of quantities items on an item by item basis (Akintoyeand Fitzgerald, 2000). Further the study shows that the major causes of poor practice and inaccuracy in cost estimating continue to be the lack of practical knowledge of the construction process by those responsible for the estimating function, insufficient time to prepare cost estimates, poor tender documentation and the wide variability of subcontractors' prices.

## **2.2. VIEW OF EXISTING BEST ESTIMATION PRACTICES THROUGH PREVIOUS STUDIES**

Standard guides are identified as cost estimate guides and those are available from other government and nongovernment agencies that were relied on to determine the processes, practices, and procedures most commonly recommended in the cost estimating community. There are number of practices that have been developed as the estimation practices for different kind of construction works. The research therefore explored the estimation practices from five different sources. Table 1 shows the summary of estimation practices.

Table 1: Analysis of Steps of Estimating Practices

Steps of New Estimation Practices Proposal for Sri Lankan Contractors	Practice01 (Chartered Institute of Building, 1997)	Practice02 (Department of Energy United States of America, 2011)	Practice 03 (Department of Infrastructure, Transport, Regional Development and Local Government of Australia, 2008)	Practice 04 (Pratt, 2011)	Practice 05 (Washington State Department of Transportation, 2008)
Examine received tender documents and Project Information	X		X	X	X
Prepare tender time table, visit to site for Identify Ground Rules and Assumptions	X	X		X	X
Prepare the method and programme for the project	X	X		X	
Take off Quantities and obtain data	X			X	
Arrange mid tender review meetings	X			X	X
Build up rates and quotations analysis	X			X	
Prepare base estimate (Budget) and select the subcontractors	X	X	X	X	X
Price preliminaries, measured works and subcontractors work	X				X
Conduct Risk and sensitivity analysis		X	X	X	
Review and the approval of the budget from the management	X	X	X	X	X
Prepare and document the detail estimate	X			X	X
Adjustment for the price escalation and determine the markup decisions	X		X	X	X
Prepare cash flow and present BOQ/ Detail Estimate to management for Approval	X	X	X	X	X
Update the estimate to reflect the actual cost of changes		X	X		

Using Table 1, the estimation practice for Sri Lankan construction industry is proposed with sixteen steps.

#### Proposed Estimating Practice for Sri Lanka

1. Examine received tender documents and Project Information
2. Adjustment for the price escalation and determine the mark-up decisions
3. Build up rates
4. Prepare and document the detail estimate
5. Review and the approval of the budget from the management
6. Quotations analysis
7. Prepare tender time table, visit to site for Identify Ground Rules and Assumptions
8. Calling inquiries
9. Price preliminaries, measured works and subcontractors work

10. Update the estimate to reflect the actual cost of changes
11. Prepare the method and programme for the project
12. Prepare cash flow and present estimate to management for Approval
13. Conduct Risk and sensitivity analysis
14. Prepare (base estimate) net pricing and select the subcontractors
15. Arrange mid tender review meetings
16. Take off Quantities and obtain data

### 3. RESEARCH METHODOLOGY

#### 3.1. RESEARCH APPROACH

The current study adopted survey approach to investigate the research phenomena. The questionnaires were issued to the professionals who involved in estimation and tendering of construction projects. The selected professionals: construction engineers, project managers and quantity surveyors are from both contracting and consultancy organisations. From the comprehensive literature survey, the Best estimation practice for Sri Lanka is proposed. Using the results of literature review, the questionnaire was prepared. A total of 100 questionnaires were distributed among randomly selected professionals. 75% of the questionnaires were returned. The questionnaire survey ranked the steps of proposed estimation practice under the perspectives of contractors and consultants separately.

In addition to questionnaire survey, semi structured face-to-face interviews were conducted with the experienced professionals to identify the limitation in practicing the proposed estimation practice and the suggestions to meet the best estimation practices in Sri Lanka. A total of seventeen participants were involved in semi structured interviews. Out of 17 interviewees, 9 represented contracting organisations and the remaining 8 are employed in consultant organisations. Thus, the study consists of both Qualitative and Quantitative approaches in order to achieve the desired objectives.

#### 3.2. DATA ANALYSIS TECHNIQUE - RELATIVE IMPORTANCE INDEX (RII)

The results from questionnaire survey were analyzed using Relative Importance Index (RII). The RII technique has been widely used in construction research for measuring attitudes with respect to surveyed variables. Likert scaling was used for ranking questions that have an agreement level. The respondents were required to rate the importance of each factor on a 5-point Likert scale using 1 for not important, 2 for of little important, 3 for somewhat important, 4 for important and 5 for very important. Then, the relative importance index was computed using the following equation:

$$\text{Relative Importance Index} = \frac{\sum W}{AN} = \frac{5n1+4n2+3n3+2n4+1n5}{5N} \quad (\text{Eq: 01})$$

Where  $W$ , which is the weight given to each factor by the respondent, ranges from 1 to 5;  $n5$  = the number of respondents for very important;  $n4$  = the number of respondents for of important;  $n3$  = the number of respondents for somewhat important;  $n2$  = the number of respondents for little important; and  $n1$  = the number of respondents for not important.  $A$  is the highest weight (i.e., 5 in the study) and  $N$  is the total number of samples. The Relative Importance Index ranges from 0 to 1.

#### 3.3. DATA ANALYSIS TECHNIQUE - CONTENT ANALYSIS

Fellows and Lui (2003) mentioned that in qualitative content analysis emphasis is on determining the meaning of the data and data are given coded allocation to categories and groups of 'respondents' from whom the data were obtained are fitted to these categories. Range of qualitative data analysis software are currently available to assist in content analysis process, including Ethnograph, ATLAS.ti, WinMAX,

Hyper-RESEARCH and NVivo. This study selected content analysis using NVivo 7 to analyze the interview output.

#### 4. RESEARCH FINDINGS AND ANALYSIS

##### 4.1. CURRENT ESTIMATION PRACTICE OF CONTRACTORS

This statistical analysis is carried out to identify the current estimating practices of Sri Lankan contractors, in order to fulfill the 2<sup>nd</sup> objective. The given best practice was proposed through the literature survey. The survey facilitates to obtain views of both contractors and consultants who are different in their interests. The contractors have been given the questionnaire to identify their current estimating practices against the best estimating practices. At the same time, the consultants have been given the questionnaire to identify level of importance of the steps which are expected to be performed by the contractors in estimation. 75 questionnaires were returned back from the professionals which including 35 consultants and 40 contractors. Table 2 indicated the steps of estimation practice and the respective RII values of consultants and contractors.

Table 2: Current Estimation Practice: Perspectives of Contractors and Consultants

Estimating Practices Steps	Consultants' Perspective		Contractors' Perspective	
	RII	Rank	RII	Rank
1 Examine received tender documents and Project Information	0.971	01	0.935	01
2 Adjustment for the price escalation and determine the mark-up decisions	0.914	02	0.905	02
3 Build up rates	0.903	03	0.840	05
4 Prepare and document the detail estimate	0.903	03	0.855	03
5 Review and the approval of the budget from the management	0.897	05	0.760	13
6 Quotations analysis	0.891	06	0.830	07
7 Prepare tender time table, visit to site for Identify Ground Rules and Assumptions	0.886	07	0.845	04
8 Calling inquiries	0.886	07	0.790	10
9 Price preliminaries, measured works and subcontractors work	0.880	09	0.840	05
10 Update the estimate to reflect the actual cost of changes	0.874	10	0.795	09
11 Prepare the method and programme for the project	0.840	11	0.775	12
12 Prepare cash flow and present estimate to management for Approval	0.834	12	0.755	14
13 Conduct Risk and sensitivity analysis	0.829	13	0.785	11
14 Prepare (base estimate) net pricing and select the subcontractors	0.823	14	0.825	08
15 Arrange mid tender review meetings	0.800	15	0.715	16
16 Take off Quantities and obtain data	0.766	16	0.750	15

From Table 2, it is shown that from the consultants' perspective, out of sixteen steps fifteen steps have RII values more than (0.800), it shows that this practice has been exclusively recommended by the

consultants as a good estimation practice for the Sri Lankan contractors. Therefore this confirms the proposed estimation practice from the existing literature suits to Sri Lanka. Furthermore, as per the ranking of RII “Examine received tender documents and Project Information” was ranked as the first most important step by the consultants with very high relative important index of (0.971). Similarly, according to contractors first most step is identified as “Examine received tender documents and Project Information” with the RII value of 0.935. This seems that the contractors and consultants are of the same opinion. The first and foremost thing for a contractor is to study and understand the information about the project and the important particulars attached thereof. It will enormously help the contractors to minimize their errors especially on scheduling, pricing and all other steps of estimation. The step: *Adjustment for the price escalation and determine the markup decisions*, is identify as the second important step in estimation by the contractors with RII value of 0.905 and the consultants with 0.914 RII value. *Prepare and document the detail estimate, Build up rates* are identified as the third important step by the contractors with the RII value of 0.903 while consultants identified *Prepare and document the detail estimate* (RII-0.855) , *Prepare tender time table, visit to site for Identify Ground Rules and Assumptions* (RII-0.845) as the third and fourth important steps.

Thus, the above Table 1 revealed that the contractor and consultant have identified that all sixteen steps are important by giving the RII value as above 0.80. (There are some items fall RII below 0.80). However, the priority order of the contractors and the consultants slightly differs in the identified steps. Further, the expectation of consultants’ are always high compared to the contractors’ current practices in estimation. Therefore, the research tends to investigate the limitations in following the proposed best estimation practice by the contractors.

#### 4.2. LIMITATIONS IN PRACTICING THE PROPOSED BEST ESTIMATION PRACTICE

The semi structured interviews were carried out with the professionals who were experienced in estimation of projects. The participants were asked to indicate the limitations in following the proposed best estimation practices up to the expectation of consultants. The pool of interview participants included contracting organisation professionals: 6 chief estimators, and 3 senior quantity surveyors and consulting organisation professionals: 3 managing directors, 2 associate directors and 3 chief quantity surveyors.

The collected data through interviews were analyzed using content analysis. The result of content analysis is shown in the following Table 3.

Table 3: Limitations in Practicing the Proposed Best Estimation Practice

Limitations	Contractors		Consultants		Total	
	Frequency	%	Frequency	%	Frequency	%
Limited time to estimate	7	77.77	6	75.00	13	76.47
Lack of knowledge of employees	6	66.66	5	62.50	11	64.00
Inadequate employees	5	55.55	5	62.50	10	58.82
Improper documents	3	33.33	5	62.50	8	47.05
Work overload	2	22.22	6	75.00	8	12.50
Delay in quotations	3	33.33	2	25.00	5	29.41
Improper communication	1	11.11	3	37.50	4	23.52
Lack of experience of employees	1	11.11	2	25.00	3	17.64
Lack of resource	2	22.22	1	12.50	3	17.64
Changes through addendums	1	11.11	2	25.00	3	17.64
Improper record keeping	1	11.11	1	12.50	2	11.76

Limitations	Contractors		Consultants		Total	
	Frequency	%	Frequency	%	Frequency	%
High competition	1	11.11	1	12.50	2	11.76
Client unawareness	1	11.11	0	0.00	1	5.88
High estimator's risk	1	11.11	0	0.00	1	5.88
No standard to tenders	1	11.11	0	0.00	1	5.88
No standard document to refer	0	0.00	4	50.00	4	23.52
Unawareness of improper estimate	0	0.00	3	37.50	3	17.64
Poor management commitment	0	0.00	1	12.50	1	5.88

Table 3 listed the limitation in practicing the proposed best estimation practice with the respective frequencies of contractors' and consultants' opinion. There were a total of seventeen limitations found. The participants (7 contractors and 6 consultants) indicated that the 'limited time for estimation' as the most critical limitation. Even though a duration of two weeks is provided for estimation, the organisation is in a critical position to handle number of projects with the limited staffs. The research revealed that the limitations: 'Lack of knowledge of employees', 'Inadequate employees' are identified as 2<sup>nd</sup> and 3<sup>rd</sup> critical limitations respectively. The contractors agreed that the professionals employed in their firms are not with the expected knowledge level to perform estimation. Thus, the professionals pointed out the limitation in practicing the proposed estimation practice.

The research further investigated the solutions for the identified limitations. The next subsection illustrates the finding on the solutions for the identified limitations in practicing the proposed best estimation practice.

#### **4.3. SOLUTIONS FOR THE IDENTIFIED LIMITATIONS IN PRACTICING THE PROPOSED BEST ESTIMATION PRACTICE**

The research participants were asked to indicate the solutions for limitations in following the proposed best estimation practices up to the expectation of consultants. The result of content analysis is indicated in the following Table 4.

Table 4: Solution for the Identified Limitations in Practicing the Proposed Best Estimation Practice

Solutions	Contractor		Consultant		Total	
	Frequency	%	Frequency	%	Frequency	%
Prepare programme for estimation	4	44.44	2	25.00	6	35.29
Get extension of time	4	44.44	3	37.50	7	41.17
Provide training	4	44.44	3	37.50	7	41.17
Keep tender time table	3	33.33	1	12.50	4	23.52
Keep proper contacts	3	33.33	3	37.50	6	35.29
Make decision to tender	3	33.33	2	25.00	5	29.41
Recruit suitable person	2	22.22	5	62.50	7	41.17
Keep and update database	2	22.22	5	62.50	7	41.17
Conduct seminars	1	11.11	3	37.50	4	23.52

Maintain all records	1	11.11	2	25.00	3	17.64
Form high capacity tendering division	1	11.11	0	0.00	1	5.88
Use same standards	1	11.11	0	0.00	1	5.88
Provide standard to estimate	0	0.00	3	37.50	3	17.64
Consultant need to provide proper documents	0	0.00	3	37.50	3	17.64
Improve coordination among employees	0	0.00	2	25.00	2	11.76
Improve management concerns	0	0.00	2	25.00	2	11.76
Distribute works	0	0.00	1	12.50	1	5.88

The above table indicated that the most preferred solution is identified as 'Prepare programme for estimation' by the 4 contractors and 6 consultants. The participants further emphasised that the prepared programme of work should be strictly followed. The next best solutions identified by the interviews are 'get extension of time from the consultant' and 'provide training to the staffs'. Thus Table 4 furnished the opinion of contractors' and consultants' on solutions separately.

In addition to the above findings, the research compiles the limitations with the suitable solutions for each limitation in the following Table 5.

Table 5: Limitations and the Respective Solutions

Limitations	Solutions
Limited time to estimate	Get extension of time Keep tender time table Keep programme for estimation Keep proper contacts Recruit suitable persons Keep and update data base Maintain all details Form high capacity tendering division Improve management concerns Improve coordination among employees
Lack of knowledge of employees	Recruit suitable persons Conduct seminars Provide training
Inadequate employees	Recruit suitable persons
Improper document	Consultant need to provide proper documents Use same standards to tendering
Work overload	Form high capacity tendering division Improve coordination among employees Distribute works Improve management concerns
Delay in quotations	Keep proper contacts
Improper communication	Conduct seminars Provide training Improve coordination among employees
Lack of experience of employees	Conduct seminars Provide training

Limitations	Solutions
	Recruit suitable persons
Lack of resource	Improve management concerns
Changes through addendums	Consultant need to provide proper documents
Improper record keeping	Keep and update data base Maintain all details
High competition	Improve management concerns Recruit suitable persons
Client unawareness	Conduct seminars
High estimator's risk	Improve management concerns Recruit suitable persons
No standard to tenders	Use same standards Consultant need to provide proper documents
No standard document to refer	Provide standard to estimate
Unawareness of improper estimate	Conduct seminars Provide training
Poor management commitment	Improve management concerns

## 5. CONCLUSIONS AND RECOMMENDATIONS

A comprehensive study about Sri Lankan contractors' estimation practice was conducted to determine the current estimation practice and find out the solution for their limitations. For this research two types of sample groups were selected, which are namely contractors and consultants. The study was conducted through questionnaire survey and interviews. In order to achieve the objective, a mixed of qualitative and quantitative approaches was used.

The first objective "Propose the best contractors' estimation practice that can be used by the contractors", was achieved through the literature review. The second, third, and fourth objectives of this research were attained through the questionnaire survey and interviews.

The second objective was to "Identify the current estimation practice used by the contractors in Sri Lanka". Through issued questionnaire with proposed best estimating practice with 16 steps, current estimation practice level was identified. Even though Sri Lankan contractors are following all those steps they can't give equal important to each steps which are identified in best estimation practice as consultants' expectation due to some limitations. In addition, this study revealed the consultant expectation from the contractors related to each steps. As a conclude contractors did not provide their importance for each steps to fulfill consultants expectation.

Third objective of this study was to find out those limitations. Content analysis technique was used to achieve the third objective. Interviews were carried out to find the limitations which are considered by contractors and consultants as affecting the importance level of each step in proposed best estimation practice in Sri Lankan construction industry. Eighteen limitations were identified by both of them. The identified limitations are Limited time to estimate, lack of knowledge of employees, inadequate employees, improper document, work overload, delay in quotations, improper communication, lack experience of employees, lack of resource, changes through addendums, improper record keeping, high competition, client unawareness, high estimator's risk, no standard to tenders, no standard document to refer, unawareness of improper estimate and poor management commitment.

Identify the solutions for the identified limitations were objective number four. To fulfill the objective number four, the perspective of contractors and consultants of the essential solutions for the identified limitations in tender cost estimate in Sri Lanka was studied, these solutions were separately analyzed through content analysis using the obtained data from interviews, in the perspective of contractors and consultants. Seventeen solutions were identified such as Keep programme for estimation, get extension of time, provide training, keep tender time table, keep proper contacts, make decision to tender, recruit

suitable person, keep and update database, conduct seminars, maintain all records, form high capacity tendering division, use same standards, provide standard to estimate, consultant need to provide proper document, improve coordination among employees, improve management concerns and distribute works.

According to the previous analysis both parties know and accept what are the limitations creating by themselves and recommend the solutions for those limitations. This research can be helpful to overcome those limitations and achieve the best estimation level by Sri Lankan contractors.

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