Chapter 3

Research Methodology

3.1 Introduction
The methodology of this study comprised identification of the problem statement, literature review, collecting data, analysis of data, discussion of results, conclusions and recommendations. Figure 3.1 shows the flowchart of the research methodology through which the objectives of this study were achieved.

3.2 Methodology
A comprehensive literature review conducted on the problem identified potential Client related causes, Contractor related causes and Consultant related causes that affect on delay in hotel refurbishment. The identified possible causes of delay in construction projects were further refined after discussion with parties involved in hotel refurbishment projects. The questionnaire was prepared with the adjustments to the identified possible causes in delaying projects as to suite with hotel refurbishment projects. After the pilot survey the questionnaire was further refined and the finalized questionnaire was distributed. The literature review provided the basis for the development of the questionnaire. The aim of the questionnaire was to collect data for ranking the potential delaying causes in the hotel refurbishment industry of Sri Lanka.

3.3 Questionnaire Survey
A questionnaire was prepared to cover the following factors.
- Causes pertinent to clients
- Causes pertinent to consultants
- Causes pertinent to contractors
- Causes pertinent to project condition
- External Causes
Face to face meeting and telephone conversation were carried out to ensure that all the causes in the questionnaires are completed and to obtain personnel views on the subject.

**Problem Identification**

- Literature review

**Identification of possible causes of delay in construction industry**

- Design of questionnaire and pilot survey

- Carry out questionnaire survey for contractors, consultants, hotel managers

**Data analysis using**

- Relative Important Index (RI) and Spearman's Rank Correlation Coefficient

- Interpretations of results and propose recommendations

**Figure 3.1 Flow Chart of Research Methodology**

Five questionnaires were distributed among a sample of respondents comprised of an Architect, Hotel Engineer, Group Engineer, and two Contractors for pre-testing. In addition to the above, each person was given the opportunity to express their view of overcoming the above delaying factors. Comments received were included in the questionnaire and improved.

The questionnaire was then distributed among purposively selected 65 representatives of Clients, Contractors and Consultants by e-mail and forwarding
personals copies. Respondents included Hotel Managers, Engineers, Contractors, Sub Contractors and Consultants (Electrical and M&E Consultants). Fifty two filled questionnaires were received. Out of that 21 filled by Client Representatives, 19 by Contractor representatives and remaining 12 by Consultant representatives.

Delaying Causes will be categorized and rank them in order to identify the most significant causes. The identified causes are listed in the questionnaire and a sample questionnaire is attached in Annexure 1.

3.4 Analysis of Questionnaires

Section A of the questionnaire was designed to obtain information about the respondent and other sections were focused on causes and their ranking. A five point weighing scale ‘w’ was included to indicate the relative importance of a contributor ‘i’ in a construction delay. The scale comprised, extremely significant- 5, very significant- 4, moderately significant- 3, slightly significant- 2 and not significant-1. Moreover, if the respondent does not know about the factor then zero was assigned. A factor rated 4 or 5 is considered as a significant contributor of refurbishment delay while that with 1 or 2 interpreted as an insignificant contributor. Three was considered as uncertain.

3.5 Relative Importance Index (RII)

The relative importance index (RII) was calculated to indicate the relative importance of a contributing factor i to the refurbishment delay. RII is given by:

\[ RII = \frac{\sum Wi}{A \times N} \]  

Equation (1)
Where, \( w \) is the mentioned scale for rating a factor by the respondents which ranges from 1 to 5. \( A \) is the highest weight in the scale; and \( N \) is the total number of respondents.

### 3.6 Agreement Analysis

The Spearman rank correlation coefficient \((r_s)\) is used to show the degree of agreement between the ranks of any two project parties i.e. consulting engineers and contractors. is given by the Spearman rank correlation coefficient \(r_s\) (Aczel and Sounderpandian, 2006; Fong et al., 2006).

\[
\begin{align*}
\rho_s &= 1 - \frac{6 \sum d^2}{n(n^2 - 1)} \\
\text{Equation (2)}
\end{align*}
\]

Where \( d \) is the difference between the ranks given by the two respondent for an individual cause and \( n \) is the number of pair variables in the data set, i.e. 75 and 5 for all the delaying factors and the categories respectively. The coefficient \( r_s \) ranges from -1 to +1; where +1 and -1 suggest a perfect positive and negative correlation at certain significance levels, and 0 represents no correlation between the ranks.

### 3.7 Significance Test

Apart from the \( p \) value for the correlation coefficient, the criterion in accepting the significance of a correlation is determined by a \( t \)-test at certain significance level.

\[
\begin{align*}
\tau &= \rho_s \left( \frac{n - 2}{1 - \rho^2} \right) \\
\text{Equation (3)}
\end{align*}
\]

To determine whether parties displayed significant agreement in their rank, the null hypothesis \((H_0)\) that “client and contractor, client and consultant and contractor and consultant do not agree on ranking of causes of delay factors” is tested using \( t \)-test at 95% confidence level. The alternate hypothesis \((H_1)\) is selected based on the rejection of null hypothesis.