CHAPTER 8

FINDINGS AND CONCLUSION

8.1 INTRODUCTION

This chapter summarizes the findings and conclusions of the study. An extensive literature survey was carried out, and the information was used for the questionnaire preparation. The questionnaire was provided to the stakeholders of the construction industry, and their views were collected and analysed. Based on the analysis, suitable suggestions are provided. The following are the findings and conclusions made in this study.

8.2 RESPONDENT CHARACTERISTICS

In this study, 86% of males and 14% females participated in the questionnaire survey. Based on the survey 92% of males in owner, 85% of male consultant, and 91% of male in contractors, 7.69 % of female in owner, 14.82% of male consultant, and 8.7 % of male in contractor are participated in the questionnaire survey. Above survey, Male participants more dominated in the construction industries which indicate to find out the perspective of the relative importance of project performance So the respondents’ gender characteristics have influenced the time overrun of the projects.

The target groups in this study are stakeholders such as Owner, Consultant and Contractor. Of the participants in the survey, 33.6% were
owners, 23.2% consultants and 43% contractors. So the respondents participated are a suitable indication to find out the perceptive of the relative importance of project performance indicators of the owner, consultant and contractor parties. So the target groups of respondents’ have influenced on the results.

32.26% of the respondents had less than 5 years of experience, 29.68% had 5 to 10 years of experience, 25.16% had 11 to 15 years of experience and 12.9% had more than 15 years of experience respectively. 67.74% of the respondents had an experience of more than 5 years.

26.6% of the companies where the respondents worked, had an annual turnover of less than 1000 million INR, 27.8% had 1000 to 5000 million INR, 28.3% had 5000 to 10000 million INR and 17.3% had more than 10000 million INR. 21% of the companies were involved in residential building construction, 37% in commercial building construction, 14% in infrastructure development projects, and 14% in industrial building construction.

So the characteristics of the respondents participated are a suitable indication to find out the perceptive of the relative importance of project performance indicators of the owner, consultant and contractor parties. So the respondents’ characteristics have influenced on the results.

Time overrun was determined about 40% in different type of existing projects. The percentage contributions of each type of projects in the construction time overrun, are industrial is 10%; commercial is 12.5%; residential is 17.5%; and infrastructure is 27.5%.

Based on the ranking of the respondents the list of critical factors from the perspectives of Owners’, Consultants’ and contractors’ is given in Table 8.1.
“Shortage of labour” was identified as the prime reason for time overrun from the owners’ perspective, whereas consultants rated it as tenth, and contractors rated it as the fifth most important factor for time overrun.

“Shortage in construction materials” was identified as the prime reason for time overrun from the owners’ perspective, whereas consultants rated it as third, and contractors rated it as the fourth most important factor for time overrun.

The other major influencing factors are “Materials selection and changes in types and specifications during construction,” “Financing by contractor during construction”, “Finance between the owner and contractor”, “Lack of skilled labour”, and “Slow delivery of materials”, “Poor quality of materials” is the fifth important cause of time overrun from the contractors’ view. It was identified as the sixth and ninth cause of time overrun by owners’ and consultants’ respectively. The causes lead to time overrun in the project schedule and productivity. The quality department must check before supply of materials during the construction stage.

The financial factors were the major reported causes of project delay.
### Table 8.1 Factors that lead to Time overrun

<table>
<thead>
<tr>
<th>Rank</th>
<th>Critical Factors in Owner's Perspective</th>
<th>Critical Factors in Consultant's Perspective</th>
<th>Critical Factors in Contractor's Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shortage of labour</td>
<td>Imported, Ordered materials and plant items</td>
<td>Materials selection and changes in types and specifications during construction</td>
</tr>
<tr>
<td>2</td>
<td>Cash Flow (Inflow &amp; Outflow)</td>
<td>Lack of Motivation</td>
<td>Poor maintenance of equipment</td>
</tr>
<tr>
<td>3</td>
<td>Shortage in construction materials</td>
<td>Lack of Communication</td>
<td>Poor procurement of materials</td>
</tr>
<tr>
<td>4</td>
<td>Materials selection and changes in types and specifications during construction</td>
<td>Financing by contractor during construction</td>
<td>Shortage in construction materials</td>
</tr>
<tr>
<td>5</td>
<td>Financing by contractor during construction</td>
<td>Slab of payment during construction</td>
<td>Financing between the owner and contractor</td>
</tr>
<tr>
<td>6</td>
<td>Financing between the owner and contractor</td>
<td>Shortage in construction materials</td>
<td>Imported, Ordered materials and plant items</td>
</tr>
<tr>
<td>7</td>
<td>Lack of skilled of labour</td>
<td>Unqualified work force team</td>
<td>Availability of equipment</td>
</tr>
<tr>
<td>8</td>
<td>slow delivery of materials</td>
<td>Disruption of accessories</td>
<td>Lack of skilled labour</td>
</tr>
<tr>
<td>9</td>
<td>Poor quality of materials</td>
<td>Financing between the owner and contractor</td>
<td>Poor quality of materials</td>
</tr>
<tr>
<td>10</td>
<td>Slab of payment during construction</td>
<td>Availability of equipment</td>
<td>Shortage of labour</td>
</tr>
</tbody>
</table>
The material delay in supply and quality related factors were the second most reported cause of the project delay. The values of the Spearman’s rank correlation coefficients show that there is a relatively good agreement between two groups of parties in ranking the importance of delay causes. The highest degree of agreement is 81.5% between owners and contractors, while the lowest is 55.5% between consultants and contractors. The above results show the most influential factors, which are responsible for the time overrun in construction projects.

The factor analysis is used to reduce numerous correlated factors into five underlying factors. The five groups of underlying factors are a) Resource Availability; b) Resource Supply Related; c) Financial Issues; d) Labour Involvement; and e) Shortage of Labour.

The first factor (Resource Availability) consisted of eleven positively loaded factors, and it influenced 40.61% of time overrun in the total variance. Resource availability factors were labor injuries, disputes and strikes, manufacturing difficulties of special materials, disruption of accessories, damage of materials in storage, personal conflicts among labour, damage of sorted materials while they are needed urgently, idle time of equipment and imported, and ordered materials and plant items respectively. These criteria share a common link to Resource availability issues. A good resource presence is also important for improving the competitive edge of organizations, in increasingly complex and resource sensitive construction projects.

Resource Supply Related factors were found to influence 7.02% time overrun of the total variance. Resource Supply Related consist of shortage in construction materials, availability of equipment, complication of
advanced technology equipment, poor maintenance of equipment, slow
delivery of materials, poor quality of materials, transportation of equipment,
and materials selection and changes in types and specifications during
construction.

Labour involvement has influenced 5.30% of the time overrun in
total variance. Labour involvement consists of six measured factors: lack of
motivation, Obtaining permits for migrant labour, lack of communication,
absenteeism of labour, lack of mobilization, and Complication of hire.

Financial issues accounted for 5.51% of time overrun in total
variance. Financial Issues consists of six measured factors: slab of payment
during construction, financing by contractor during construction, financing
between the owner and contractor, unavailability of financial incentive, cash
flow (Inflow & Outflow), and Proportion of offsite prefabrication.

Shortage of labour has influenced for 3.63% of the total variance. It
consists of five measured factors: migrant labour, lack of skilled labour,
unqualified work force team, shortage of labour and poor procurement of
materials.

The time overrun index model was developed, by using the
structural equation model. Time Overrun Index (TOI) is an indicator to
measure the percentage of time overrun for a particular project. The expected
percentage of construction time overrun could be estimated for a given
scenario using the model. The model was validated with details of twenty
seven completed projects. The model predictions matched with the field
observations.

By knowing the expected deviation in advance the planners can
prepare the schedule of the project accommodating the expected deviation.
The major groups like shortage of labour (32%), resource availability (23%), finance issues (16%), resource supply related (15%) and labour involvement (14%), have contributed to the construction delay; so, these percentages should be taken into consideration during the planning and scheduling process, to minimize the construction delay.

8.3 CONCLUSION

The important conclusions drawn from the perception analysis with respect to identifying and evaluation of factors affecting time overrun in the construction projects, are presented.

From the statistical results, the top fourteen factors in the importance index ranging from 63% - 68% are taken as the main factors. From the above results, it is concluded, that the main factors are Materials selection and changes in types and specifications during construction, poor maintenance of equipment, shortage in construction materials, finance between the owner and contractor, shortage of labour, poor procurement of materials, lack of skilled labour, availability of equipment, imported, ordered materials and plant items, poor quality of materials, complication of advanced technology equipment, cash Flow (Inflow & Outflow), slab of payment during construction, and financing by the contractor during construction. The time overrun index has been derived from the case study with a strength of 68%. The major groups of factors like Shortage of Labour is 32%, resource availability 23%, finance issues 16%, resource supply related (15%) and labour involvement 14%, have contributed to the construction time overrun; so, these percentages should be taken into consideration during the planning and scheduling process to minimize the construction time overrun. The developed model can be implemented in any construction project to find the time overrun duration. By knowing the expected deviation in advance, the planners can prepare the schedule of the project, accommodating the expected
deviation. Making the planning and scheduling of activities a continuous process during construction, and also tracking the project with time and resources, will minimize the time and cost overruns.

8.4 RECOMMENDATIONS

The following recommendations may be given to construction professionals to minimize the delay in the construction project,

1. By taking care of the above mentioned critical factors during project scheduling in the present and future projects, construction participants can reduce and control the extent of delays.

2. According to the percentage contribution of each group in the causes of delay, suitable weightages should be given to the resources during the scheduling process to minimize the delay.

3. Manpower related issues have the highest percentage contribution in the causes of delay; this can be overcome by assigning enough number of skilled labour and motivate them to improve labour productivity.

4. Material related issues can be overcome by proper planning in the procurement of materials, and by avoiding material selection, and changing types and specifications during construction.

5. Equipment related issues can be minimized by the proper management and maintenance of equipments.

6. By making the planning and scheduling of activities as a continuous process during construction and also by tracking the project with time and resources, the time and cost overruns may be minimized.
7. Finally, it is recommended that the delay in construction projects can be minimized by strengthening the Project Implementation Unit (PIU) and Project Management Unit (PMU).

This study provides a good guidance for managerial intervention and also some guidelines and actionable information that managers can utilize to manage their projects.