CHAPTER – 5 RESEARCH SUMMARY AND CONCLUSION

Chapter Summary

This chapter brings out the precipitates of the above discussions and attempts at weaving the various opportunities to improve Plant maintenance function and Lean philosophy into a fabric in order to capture overall view of the study.

5.1 Summary

Plant Maintenance function is struggling to ensure the services to all the departments in terms of performance, availability, scalability, reliability with the main responsibility of asset life management. During the preliminary research study it was found that the relationship in terms of support from maintenance department with other departments is very weak and the maintenance department needs to change the negative image of their profession. If the maintenance team wants to become customer-focused, maintenance professionals must learn to look at themselves through eyes of the customer.

Based on the evaluation of current processes in Plant Maintenance of manufacturing sector, this research aims at achieving the following research objectives:

1. To study the plant maintenance practices and to identify the common plant maintenance practices

2. To study the implementation level of identified common plant maintenance practices and the level of internal customer satisfaction in lean and non-lean principle following organizations

3. To study the lean tools and techniques in the lean principles adhering organization
4. To study the correlation between the identified lean tools and techniques with the common plant maintenance practices

5. To study the problems, difficulties, and resistance faced during the lean implementation in maintenance functions and suggest a practical model for implementation

In order to achieve the research objectives, a basic sample study was conducted as a preliminary research survey for understanding “where we are” and the survey is giving the basic idea on “What is needed” by using internal customer satisfaction and opinion survey. “What is needed” helps the research scholar to identify the required tools and techniques from the Lean Philosophy through the secondary data and integrate the same in bringing the integrity with the common maintenance practices to have a high level of internal customer satisfaction.

The structured questions were prepared with eight streams of common maintenance practices with twenty four questions. To confirm the reality between the voice of the internal customer (internal customer needs) and the existing maintenance practices, the voice of the internal customer was considered during research questionnaire streams and framing the research questionnaire which was obtained from preliminary research survey.

The questions are framed under the research questionnaire streams of Service Quality, Inventory Management, Visual Management, Scheduling system and Reliability which has proportionality with Equipment Management. Inventory Management has the research questionnaire streams of Visual Management, Scheduling system, Inventory Management and Service quality. People Management are with Service Quality, Team working & Motivation, Relational Quality and Commitment to Quality. EHS Management system covered with Visual Management, Reliability and Team working & Motivation research questionnaire streams.

In order to reach the research objectives and answer the research questions, the following strategies for collecting data were adopted: A questionnaire survey and structured interviews.
The purpose of the research questionnaire is to understand satisfaction level of the internal customer with the existing maintenance practices and the level of consistency in the existing practices. The research questionnaire was circulated to the 34 manufacturing industry across various states of Indian manufacturing organizations. In that 17 are Non Lean principle practicing organizations and 17 are Lean principle practicing organizations. 410 samples were collected across the various positions in the organizations.

The Internal consistency reliability scores of the research questionnaire model ranged from 0.990 to 0.998, indicating that scales were more reliable. After the Internal consistency reliability analysis with means of respondents’ responses to the items that measure maintenance management constructs, it was concluded that the maintenance management implementation instrument is reliable. The data obtained through this instrument was used for subsequent data analysis.

From the normality test of Lean principle practicing organization it is confirmed that the p- value of Service Quality, Reliability, Inventory System, Teamwork & Motivation, Scheduling System, Visual Management and Commitment to Quality are >0.005, hence there is a no significant deviation in the responses of the respondents in the research questionnaire streams. The other research questionnaire stream of Relational Quality has its p-value <0.005 and found there is a significant deviation in the response of the respondents.

As per the normality test using Anderson Darling method of the responses of the Non Lean principle practicing and Lean principle practicing Organization, it is observed that the Relational Quality between the Maintenance team and their Internal Customer is poor. Hence it there is an opportunity for the scholar to precede the study to find the best method for improving the Relational Quality which intern improves the Internal customer satisfaction.

In confirmation with the normality test, the scholar proceeded with the hypothesis test to confirm the significance difference in the responses of the respondents between Non Lean principle practicing and Lean principle practicing organization using “two samples t-test”. In two sample t-test analyses, it is found that the p-values of the eight elements hypotheses from the
respondents of Non lean principle and Lean principle practicing organizations are <0.005, hence null hypotheses are rejected providing the result that eight streams of common maintenance practices of Non Lean principle practicing organizations is not equal to Lean principle practicing organizations. The data analysis proved that the possibilities of providing value addition to Plant Maintenance department by using the lean principles to effectively manage and maintain the resources, processes and procedures to reduce the overhead and wastage for improving internal customer satisfaction.

Lean philosophy with applicable tools and techniques for plant maintenance functions are identified from the literature review and from the Lean Principle implementation organization and correlated with the common maintenance stream and derived a Lean Maintenance model.

5.2 Research Evaluation

The research has been completed. It is necessary to evaluate this study in the context of its limitations. One of the potential disadvantages was it is observed that the Relational Quality between the Maintenance team and their Internal Customer is poor and significant deviation in the response of the respondents. Research finding may be biased due to poor personal relationship in the study organizations. First, data used to test the theoretical models came from only 17 Non Lean principle practicing and 17 Lean principle practicing organizations with limited variables which fit in to common maintenance practices. Second, the measure of perceived internal customer satisfaction in particular is comparatively weak, because general perception of internal customer satisfaction is asked to the respondents in their respective organization. Due to this also research findings might have been biased.
5.3 Future Research Perspectives:

The issues generated from this study would address as recommendations for the future research. The future research can start from the following findings:

- The study can be repeated for re-examining the validity of its findings
- The common maintenance practices and streams can be revalidated for covering the full maintenance scope
- Increase in sample sizes in Non lean principle and lean principle practicing organization in different geographical locations can help in validating the theoretical models proposed in this study
- The relationships of the common maintenance streams can be validated in different countries to test the internal customer satisfaction
- An in-depth case study would be conducted with the identified lean tools & techniques in maintenance function to gain more insight to Lean maintenance implementation model in practice
- The further extension of study towards influence of external environment helps to explore how external environment affects Lean maintenance implementation

5.4 Conclusion:

The research conclusion is derived using Lean Maintenance with outcome and result as shown in figure – 4.14. The recommendation from the outcome of the research study is implemented in pilot sample in the research study organizations and the implemented case studies are presented in International and National Conferences and reputed journals for accreditations.

The Lean Maintenance model with the common maintenance practices of People Management, Equipment Management, Inventory Management and EHS Management will create the positive feedback of unity of working close to internal customer, store the needs at point of use and brings a high degree of safety culture in the organization which interns improve the internal customer satisfaction as shown in the figure – 5.1
Figure – 5.1 Conclusion of the research