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1.1. Background

Immediately after the Second World War, the world began to witness the competitive era. In order to thrive in this competitive era, mankind is forced to evolve new and better methodologies, models and innovations. Time and again, many strategies have been adopted by the global community to face this situation. Maintenance is one of such strategies used in this competitive battleground (Murthy, et al, 2002, Tsang, 1998, and Tsang and Chan, 2000). One of the most popular maintenance models that are being currently discussed curiously among the researchers and practitioners over the past two decades is “Total Productive Maintenance (TPM)”. Although TPM was propagated during 1970s, it became popular among the researchers and practitioners only after late 1980s. TPM emanated due to the realization that the maintenance activities should not only be technologically improved but also blended with managerial concepts (Blanchard 1997). Particularly the relevance of implementing total quality for enhancing the quality of maintenance activities facilitated the evolution of TPM concepts. Today TPM is being implemented in numerous countries and fields (Ahmed et.al, 2005, Chan et.al,2005).

The fast rate of acceptance of TPM indicates the practitioners’ thirst for improving maintenance quality. However a critical analysis of the theory indicates that TPM concepts are not yet exhaustive to effect continuous maintenance quality improvement. Presumably, due to this reason, articles introducing many new tools, techniques and approaches are intended for enhancing the efficacies of TPM keep emerging in literature world (Blanchard 1997, Bamber et. al. 1999).

In essence, TPM couples the principles of maintenance engineering and Total Quality management (TQM). While many TQM strategies have been adopted, the strategy of infusing quality in maintenance engineering in accordance to the customer reactions is yet to find its authentic place in the TPM field. Meanwhile, it is observed that in this contemporary industrial
scenario, customer aspirations have become the central core of business (Paiste, 2003). While referring to various literatures on TPM, it was observed that there has been no tool or technique available in TPM to take care of customer views properly. However in TQM field, QFD has been predominantly used as an efficient tool in this direction (Chan and Wu, 2002). In this context, during the research work reported in this thesis, efforts were made to integrate the principles of QFD with that of TPM. This gave rise to the evolution of a model named “Maintenance Quality Function deployment” (MQFD). During this research work, this model was subjected to implementation studies in various industrial and educational scenarios. Further, the method of enhancing the efficacy of this model was also examined.

First, the literature was reviewed. The results of this review indicated that no activities had so far been reported on integrating QFD in TPM and vice versa. During the second phase, a survey conducted among six companies in which TPM had been implemented. The objective of this survey was to locate any traces of QFD implementation in TPM programme being implemented in these companies. This survey results indicated that no effort on integrating QFD in TPM had been made in these companies. After completing these two phases of activities, the MQFD model was designed. The details of this work are presented in this research work. Followed by this, explorative studies on implementing this MQFD model in real time environments were conducted. In addition to that an empirical study was carried out to examine the receptivity of MQFD model among the practitioners and multifarious organizational cultures. Finally, a sensitivity analysis was conducted to find the hierarchy of various factors influencing MQFD in a company. Through out the research work, the theory and practice of MQFD were juxtaposed by presenting and publishing papers among scholarly communities and conducting case studies in real time scenario.

1.2. Research Problem

Currently organizations have realized the importance by attaining maintenance quality continuously for attaining core competence in global
market. Researchers and theoreticians have suggested the use of TPM concepts for this purpose. However, it has been observed that there is no tool and technique accommodated in TPM concepts to transfer the voice of customers into practical scenario. TPM is the conglomeration of TQM and maintenance engineering principles. When TPM concepts are studied and viewed from this perspective, it is found that TPM concepts are not exhaustive in suggesting the solutions for taking care of customer voices. However, no, maintenance model exists that can take care of customers voices. In this background, the problem of the research work has been defined as follows:

"TPM is ineffective in taking care of customer voices".

1.3. Research objectives

The objectives of the research are enumerated below.

1. To study the fundamental tenets of TPM and QFD.

2. To study the various models deploying TPM and QFD.

3. To design a theoretical model which would link the features of TPM and QFD

4. To conduct investigations on the theoretically designed model.

5. To explore the practical feasibility of the theoretically designed model by conducting case studies and receptivity analysis.

6. To study the behavior of the theoretically designed model in multifarious organizational cultures.

7. To carryout sensitivity analysis of various factors influencing the theoretically designed model.

1.4. Research methodology

The research was carried out to accomplish the objectives by following a systematic methodology. The steps followed are shown in Figure 1.1. First, the books dealing with TPM and QFD principles were studied. Then, literatures
dealing with fundamentals of TPM were studied. Also, the author attended a winter school titled “Total Productive Maintenance and Strategic Maintenance Quality Engineering”, organized by Dr. S.R Devadasan and Dr. S.Muthu, sponsored by All India Council of Technical Education, India, held at PSG College of Technology, Coimbatore, India. Secondly, a theoretical model titled as "Maintenance Quality Function Deployment" (MQFD) was designed by integrating TPM and QFD principles. Thirdly, investigations were conducted with the objective of studying the practical feasibility of MQFD implementation.

Figure 1.1. Research methodology
Fourthly, an empirical study was conducted to explore the practical feasibility of applying MQFD model holistically in multifarious cultures and environments. Fifthly, the sensitivity analysis of MQFD using AHP was studied. Finally the prerequisites for successfully implementing MQFD in practical environments were explored.
1.5. Chapter organization

This research work is reported in this thesis in six parts. In the first part, the antecedent of initiating this research work has been apprised by presenting the literature survey reporting the study of previous works on TPM and QFD. After that, the principles behind designing MQFD model are described. These details are presented in the first four chapters. Second part deals with the receptivity study of MQFD, which was concluded on the podiums of academicians and practitioners. This study is discussed in the fifth chapter. Third part deals with the implementation studies. These studies are presented in chapters 6-10. Fourth part deals with the strategic receptivity of MQFD in multifarious organizational climates. This part of this research work is narrated in chapter 11. Fifth part deals with the sensitivity analysis of factors influencing MQFD implementation. The details of this study, which was carried out using the technique Analytical Hierarchy Process (AHP), are explained in chapter 12. Sixth part of the thesis deals with the concluding remarks of this research work, which are presented, in chapter 13.

1.6. Conclusion

This thesis reports a research work, which has resulted in the evolution of a model called MQFD. During this research work, unrealistic assumptions have been avoided. Hence, it is expected that both theoreticians and practitioners would find it convenient to read through the chapters of this doctoral thesis.