ABSTRACT

With the globalization of Indian economy, India has moved from a highly protected market to a free market economy with severe competition from international manufacturers. Attention to the quality of product in terms of functionality, reliability, dependability and cost has increased in several industrial sectors. The failure rate many of mass produced products/parts has to be confined within a few parts per million. Percentage defectives are no longer acceptable and hence there is a need to practice tools and techniques, which would help in “Doing things right at first time”. Process failure mode and effects analysis (PFMEA) is an engineering technique used to define, identify and eliminate known and/or potential failures, problems and errors in the manufacturing process before they reach the customer. Therefore, PFMEA along with other quality tools support the practice and philosophy of failure prevention and continuous improvement, which are the key elements of any Total Quality Management (TQM) system.

However, it is observed that there are some significant unexplored areas in the manufacturing practices of Indian automotive industry in the globalized scenario regarding the understanding of the core principles and operating guidelines on actual PFMEA implementation. Hence, it is necessary to look into the practical difficulties encountered in implementing this quality-planning tool and address the technical and organizational challenges associated with them.

It has been identified from the literature review that adequate research has been carried out in enhancing the analytical aspects of PFMEA through various theoretical approaches, methods and models. However no exclusive research has been attempted to identify the issues that deter manufacturers from effectively implementing PFMEA towards achieving manufacturing excellence in automotive sector, particularly in the Indian automotive industry that is experiencing a rapid growth with stiff competition from many international players. This has therefore been identified as a significant research gap and the present work is an attempt to bridge the gap
that explores the factors and issues, which facilitates successful PFMEA implementation.

In the light of the literature review and extensive discussions with PFMEA practitioners, a comprehensive questionnaire was exclusively structured to study the implementation issues of PFMEA in Indian automotive industry.

The questionnaire developed as a research tool in this work was sent to 250 companies and 124 companies responded, which is considered to be fairly good. The volume of statistical data necessitates use of a statistical analytical tool to process the information. The survey results were thus processed using Statistical Package for Social Sciences (SPSS). Separate statistical analysis was carried out for both descriptive statistics and inferential statistics. Some of the main statistical techniques used in the analysis include, t-test, ANOVA, kolmogorov-smirnov test, chi-square test, proximity matrix, hierarchical cluster analysis, Mann-Whitney U test, Kruskal-Wallis test and correlation analysis, multiple regression analysis. Twenty-hypothesis testing has been applied to test the significant difference and relationship between various PFMEA factors towards PFMEA implementation.

The study identified the root concerns of PFMEA implementation and the extent of relationship existing between various factors.

The study identified the need to develop a failure mode directory connected to problem directory coupled with a knowledge base for easy understanding of product and process in the implementation of PFMEA. Hence a web based software model, PFMEA-online, has been developed to facilitate easy implementation of PFMEA supported by a knowledge base using a case study of the spot welding process of car front body pillar sub assembly.

This study unveils an important dimension in the understanding of PFMEA implementation issues in the Indian automotive industry for its successful application.