ABSTRACT

Continuous improvement in the process has to be done to improve the competitive advantage of the organization. Currently, manufacturing community are increasing their thrust in the area of Total Failure Mode Effect Analysis (TFMEA), which is becoming a key competitive success factor in retaining customers, amidst the fierce competition without reducing the profit margin. As a result, during the recent period TFMEA initiatives are increasingly applied informally to achieve failure prevention in organizations. Yet, the fruitfulness of TFMEA initiatives in manufacturing organizations is not adequately nourished in a holistic manner. This is the reason why the currently adopted informal TFMEA initiatives do not adequately identify and address the failures and defects actually happening in the manufacturing process of organizations. Hence, creation of sector specific dynamic TFMEA in modern organizations has been necessitated.

In order to create a sector specific dynamic TFMEA in manufacturing arena, a model named as Foundry Total Failure Mode Effect Analysis (FTFMEA) based on TFMEA practice has been developed. There are many process failures and their associated defects that occur during the casting process in the foundry. FTFMEA facilitates the prioritizing of corrective actions in order to prevent, reduce and eliminate the failures, thus minimizing the losses occurring in the organizations. FTFMEA is incorporated with a framework to identify and estimate the deviations in the process, improper work instructions, irregular and unsystematic maintenance
of equipment used in the manufacturing process. In a nutshell, FTFMEA is a diagnosis and decision based frame work for enabling continuous improvement in process and quality of the product being produced through the prevention and reduction of failures in the organization holistically.

In order to validate FTFMEA, the process failures in two typical Indian foundries were investigated through its application. In the Foundry-1, FTFMEA was applied to reduce failures holistically. In this investigation, loss per kg of casting produced was used as a measurement tool for assessing the loss reduction and a risk management technique (RMT) namely Why – Why Analysis was used as an analysis tool along with Likerts scale. After investigating the reasons of failures and their causes, suitable corrective actions are suggested and implemented to reduce failures. FTFMEA cards and drawing were also developed to understand the effects of failures and to track the failure modes and their causes occurring in the Foundry-1. Further, education & training programme on FTFMEA was conducted to create awareness among workers and to train the FTFMEA team members about the real time implementation of FTFMEA model, to reduce failures and subsequently prevent them in future. Similar Investigation on FTFMEA conducted in the Foundry-2 resulted in significant reduction of failures with increase in the profit margins by loss reduction and process improvement.

After conducting investigations on FTFMEA, knowledge based FTFMEA (KBFTFMEA) was designed and developed. The portal was developed as a combination of data and model driven system, where the required information of the FTFMEA along with the steps needed for
FTFMEA practice were stored in the database. Ratings were given to failures based on the importance and cost consequence. In order to validate KBFTFMEA, the implementation was done in the Foundry-1 based on the data collected earlier. The data required for the FTFMEA table creation was entered by the team members to create a database. Subsequently the overall reports, FTFMEA cards, drawings, were generated by KBFTFMEA. As a result it also helps in knowledge sharing thus achieving in implementation of continuous process improvement.

On the whole, the results of the implementation studies indicated the potential of FTFMEA in preventing failures at Foundry-1 is at the range of 75%. In the case of Foundry-2, FTFMEA implementation was found to prevent failures at the range of 70%. These results indicated the practical compatibility of FTFMEA model. The implementation studies of FTFMEA suffered from few limitations. One of the limitations is that, the proposals derived to prevent failures holistically need a significant financial investment of the management. Hence at Foundry-1, management has just started to slowly implement the proposals evolved in the research work. In Foundry-2, the management has implemented few recommended actions which are easy to implement and the other recommended measures are in the pipeline.

The FTFMEA contributed in this research work was found to improve the performance of foundry organizations through the prevention, reduction, elimination of failures and their root causes. Thus, the development of FTFMEA resulted in the objective of creating dynamic FTFMEA in foundry area through the contribution of an appropriate model. The
development of KBFTFMEA was found to be highly useful in reducing paperwork based record keeping, achieving loss reduction, achieving futuristic FTFMEA initiatives and continuous process improvements. Thus the foundry industry can reap significant benefits by implementing the developed FTFMEA & KBFTFMEA models. The developed models can also be extended to other sectors and arenas, and its practical compatibility can further be investigated by conducting case studies in many more organizations to refine and enhance its practical compatibility.