ABSTRACT

Six Sigma has been widely adopted in a variety of industries as a proven management innovation methodology to produce high-quality products with the lowest possible cost. This research defines a step-by-step guide, using the DMAIC (Define, Measure, Analyze, Improve, and Control) methodology. Also the effectiveness of the DMAIC has been evaluated with a case study carried out in a south Indian foundry. This methodology is used to identify hidden waste and costs, identify and eliminate defects, increase profit margins, increase the employee’s level of commitment and satisfaction, on-time delivery and in turn to improve customer satisfaction. In this research, the prime focus is on improving customer satisfaction in the sand casting foundries.

The empirical study on employee job satisfaction upon implementing Six Sigma is also studied. The results show that participants in Six Sigma have experienced positive changes in most job satisfaction measures. Implications of the evaluation investigated with direction for further action of the company. Taguchi optimization technique for selected process parameters of green sand casting is applied to obtain optimal level of the process parameters in order to generate the optimum quality characteristics of the cast iron flywheel castings. The process
parameters considered are moisture content, permeability, loss on ignition, compressive strength, volatile content, vent holes, pouring time, pouring temperature, and mould pressure. An orthogonal array, the signal-to-noise (S/N) ratio, and analysis of variance are used to analyze the effect of selected process parameters and their levels on the casting defects. The result shows that the selected process parameters significantly affected the casting defects and a confirmation run is used to verify the results. Based on the findings of Taguchi analysis, the most significant parameters are selected for further investigation to optimize the process. The most significant parameters namely, moisture content, green strength, permeability and loss on ignition are statistically analyzed through Response Surface Methodology (RSM). The primary tools used in this implementation process are the process map, cause-and-effect matrix and the Failure Mode Effective Analysis (FMEA) for the casting process. Based on the findings, the optimized process parameters are taken for experiment and better performance obtained in the production process is confirmed. The optimized parameters obtained using Taguchi method and RSM are validated by innovative Process Window Approach (PWA) based on TRIZ (Theory to Resolve Inventive Problems—translated from a Russian acronym). PWA based on TRIZ is the most viable and innovative method for quickly evaluating the robustness of a process setup by validating the casting process optimization, and realizes an idea applying TRIZ so as to remove the casting defects. The successful validation of sand
casting process parameters optimization demonstrates the feasibility of the innovative method. Comparing the various processes used, the PWA optimized process is observed to be more efficient in determining the best casting parameters for flywheel castings. Maintaining optimal inventory and forecasting future demand is a tough task for the decision maker of any enterprise. However, it is possible to strike a balance between the ideal zero inventory and the real-world avoidance of stock out costs through base stock system. The generalized approach for obtaining the optimal base stock level to forecast stochastic demand to improve the on time delivery and thereby to improve the satisfaction of the customer in the Six Sigma environment is determined. Overall Equipment Effectiveness (OEE) is a measurement of Total Productive Maintenance (TPM) that aims to increase the availability of existing equipment and thereby increasing the efficiency of the system. The study has focused into the performance indicators and investigations have been undertaken in order to show the effectiveness and efficiency of the six sigma system. Moreover, the critical success factors for achieving TPM are also included based on the practical results gained from the study. The effectiveness of the approach is subsequently evaluated and the benefits received by the host organization through this approach by measuring OEE in the six sigma environment are analyzed. From the case study, success factors for implementing Six Sigma at foundry are identified. Some of the most critical success factors identified at foundry had not been reported much in the
earlier literatures. The main findings of the study is that, in order to succeed and get sustainable results from a Six Sigma program, Six Sigma should be integrated with process management, instead of just running Six Sigma as a separate initiative in an organization. This has been a research work, where the author had frequent visits to the company under investigation for two years and has actively influenced the changes in the company based on the knowledge gained at the company as well as on course work studies conducted at universities. In this work, the change initiative (Six Sigma implementation) under investigation has been conducted and analyzed in a single context. In addition to this, some conclusions derived using analytical generalization, applicable to a more general case, are presented in the thesis.