ABSTRACT

The industries have realized that quality and productivity are direct reflection on its production system, and a good deal of attention has been paid recently. The goals of TPM include the maximizing of Overall Equipment Effectiveness (OEE), so as to eliminate equipment failure and defects. The concept of OEE is becoming increasingly popular and has been widely used as a quantitative tool essential for measurement of productivity in manufacturing system. The idea behind the measurement of OEE is to have a metric indicating the performance of equipment. The evidence in the literature suggests that there are ambiguities in the method of OEE calculation by different organizations. However, the calculation method does influence the direction the organization will take in terms of its improvement priorities. So, care to be taken in its selection and definition.

In a process, like casting, the factor ‘yield’ contributes a lot for the assessment of performance. The existing OEE model cannot reveal the performance properly for such processes. In the calculation of OEE, the factor ‘quality’ is taken at the end of the process only. The quality in
different stages of the manufacturing process is not at all accounted so far. Also the quality parameters are not unique always. The products with multivariate quality characteristic is not addressed so far in the literature. In this research new models are proposed to overcome these deficiencies.

In the first model, the importance of the factor ‘yield’ into casting industry is analysed. From the literature it is clear that the OEE analysis can be used in different way depending upon the type of industry or process. To measure production losses using OEE, the required data can be used in terms of kilogram of input materials. In this model, the term “yield” is included in the OEE calculation of a casting industry. This model is analysed in a casting industry. From the results it is clear that the value of OEE is less because of the introduction of the term yield, in the OEE calculation. The Real Equipment effectiveness (REE) calculation with yield will give the exact picture to the management about the material utilization in the process. Also, the optimization tool Evolutionary Programming (EP) is used with MATLAB 7.0 for the optimization of OEE parameters.

In the second model, the MTBF and MTTR concepts have been used to calculate the process availability. The performance of the process is calculated based on the machine having smallest processing time and the
number of products produced by the bottleneck machine. The scrapped product has consumed irreversibly raw materials such that material yields are affected and costs are incurred. These characteristics of the process are not taken into account by the OEE measurement though they may have a more significant impact on the organization than the issues around the OEE calculation. In these circumstances, OEE needs to be augmented with other characteristics related to process capability and process waste.

In this model, analysis is made using the term yield instead of quality in OEE calculation. This model is analysed in the tyre manufacturing industry. From the results, it is clear that, in OEE calculation, the usage of the term yield is very appropriate to identify the problems underlying improvements in the process. Process availability ($A_p$), Process Performance rate ($P_p$) and yield of the process ($Y_p$) have to be calculated individually and they have to be multiplied to obtain Overall Process Effectiveness (OPE) of the manufacturing system.

The third model considers the defective products that occur at all stages of the manufacturing line. So, at each stage of the production process, the quality rate is assessed, thereby the machine producing lesser quality products can be easily identified and it will be much helpful for the
improvement process. So, actual quality rate of the line can be obtained very accurately. The Principal Component Analysis (PCA) is used to convert multivariate quality characteristics measured in one machine into univariate form. The proposed model is analysed in an automobile ancillary production industry. In the case study, it is clear that less quality rate even in one machine will reduce the quality rate of the line. This model is more effective in analyzing Overall Line Effectiveness using overall line availability, overall line performance and overall line quality, so that OLE provides real effectiveness of the line.

The OEE value is a critical performance alarm for all the industries. So, it is very important to measure this factor very accurately. The traditional methods lack in projecting the real picture of the effectiveness in the manufacturing system, leading the management to conclude wrongly that the effectiveness of the machine in the manufacturing line is good enough. The OEE models discussed in this research provides real effectiveness of the line or process. So, the problem underlying improvements can be identified perfectly to improve productivity. These proposed models are helpful to the management by calculating the OEE value accurately and guide the management in the deployment of its resources on improvement activities.