Extended Abstract

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Product rework cost minimization via Industrial Engineering techniques

Muzaffar A Shaikh

Florida Institute of Technology, USA Florida Polytechnic University, USA

Abstract:

A major cause of high manufacturing cost of a product today, is the cost of its rework due to design flaws. Rework cost can rise exponentially during the production phase of a product as compared to catching defects during its design phase. Statistical Process Control techniques that constitute the heart of sound Industrial Engineering practice, assist with the optimum design of a product. In particular, Process Control Charts, Univariate and Multivariate Process Monitoring and Control methods, Full and Fractional Factorial Designs of Experiments avoid rework costs. Beyond these Quality Engineering techniques, optimum product designs can also be secured via other viable Industrial Engineering techniques that include Linear programming, Dynamic Programming, Simulation and Modeling, and Analytic Hierarchy Process, etc. Furthermore, these IE techniques allow an industrial engineer to perform systematic sensitivity analysis by tweaking key system parameters. This type of sensitivity analysis further facilitates the industrial engineer in selecting the most practical design solution from a feasible set. Ultimately, this IE approach of optimum product design reduces the overall product cost. The aim of this paper is to develop an optimization model for quality improvement by considering quality investment in rework policies and supply chain profit sharing. To improve product's quality, the decision of process target and its tolerance is important since it directly affects the defective rate, manufacturing cost, and loss to customer due to the deviation of product from its specification. In this research, two rework policies are considered. In the first policy, the rework is done by using the same manufacturing facility, while in the second policy a new process facility was added for rework. Quality improvement in the supply chain environment is also necessary. Hence, profit sharing system is added in the model to strengthen the commitment of the suppliers in improving component quality. In the system, the manufacturer shares the profits to the supplier if the supplier can meet or exceed the quality target specified by the manufacturer. A comparison is given to determine the best quality improvement policy between those two policies considering profit sharing system. From the results of the optimization, the managers can make economic investment decision economically to correct a defective product through cost optimization model and to choose the best option toward the goal of least unit production cost. By using this model, the decision-maker can evaluate any quality investment in order to achieve significant financial return. This study develops an imperfect, multi-product production system with rework. Our objective is to minimize the joint total cost of the system, subject to service level and budget constraints. Since the objective function in the problem is convex, the existence of global optimality is assured. A solution procedure is proposed and numerical examples are provided to demonstrate the applicability of the model in real-world manufacturing problems. Finally, sensitivity analyses are provided to provide managerial insights, as well as to investigate the interdependency of the parameters.

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