

## Absorbing-Employing a Markov Chain Models to Determine Optimum Process Target Levels in Production Systems with Dual Correlated Quality Characteristics

### Abstract

Cutting costs and improving overall efficiency is essential for any manufacturing organization to compete effectively in the global marketplace. In this context, a single-stage production system with two independent quality characteristics and the different costs associated with each quality characteristic that falls below a lower specification limit (scrap) or above an upper specification limit (rework) are presented in this paper. The amount of reworks and scraps are assumed to be dependent on the process parameters such as process mean and standard deviation. Therefore, the expected total profit is significantly dependent on the process parameters. To determine process means, this paper develops a Markovian decision-making model for determining the process means. Sensitivity analysis is then performed to validate the results, and a numerical example is given to illustrate the proposed model. The results showed that the optimal process means extremely affect the quality characteristics' parameters significantly.

Keywords: Markov Chain, Process Mean, Bi-Variate Normal Distribution.

### JEL Classification:

#### 1. Introduction

In this paper, a production process with two quality characteristics is considered. A Markovian model is developed where defective items consisting of scrap and rework are produced, detected, and discarded during the process of manufacturing. To optimum the expected profit, scraps and reworks costs are considered in the model which is discussed in section 2. The optimum process means for two quality characteristics is determined in section 3. A sensitivity analysis is performed by varying the cost parameters, such as scrap cost, rework cost in section 4. A numerical example is provided in section 5.

In the manufacturing process, a product in the manufacturing process usually should generally satisfy a set of specifications. One of the important parameters of quality characteristics is the product target mean. As such, the problem of selecting the optimal target means has attracted the attention of researchers for several years, been an important research area for many years as determining the optimal target mean of a quality characteristic is financially important. Basically, in other words, if either positive or negative deviations in the two directions of quality characteristics in relation to a threshold have equal costs, then the optimal process mean of the process is represented by the median of the tolerance limits. However, as expected, when the deviation of a quality characteristic in one direction is more costly than in the opposite direction, the optimal process mean of the process is not represented by the median of the tolerance limits (Abbasi et al. 2006).

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