The Modified Carlsson's Model for Setting the Optimum Process Mean

Chung-Ho Chen

Department of Management and Information Technology, Southern Taiwan University of Science and Technology, Tainan, Taiwan 710, R.O.C.

Abstract

In 1984, Carlsson addressed the method for setting the optimum process mean when the net income takes production cost and different selling prices into account. He adopted the piecewise linear profit function to measure the net income for a product quality characteristic is normally distributed. However, the non-normal quality characteristic of product maybe occur in the industrial application. In this paper, the author proposes the modified Carlsson's models with beta and Weibull quality characteristics for determining the optimum process mean. A numerical example and sensitivity analysis of parameters will be provided for illustration.

***Key Words*:** Piecewise Linear Profit Function, Beta Distribution, Weibull Distribution, Process Mean

1. Introduction

For modern industrial statistics, one addresses product inspection, statistical process control, quality design, and product reliability. To determine the optimum process parameters is an important topic for the statistical process control. The optimal selection of process mean (manufacturing target) will directly affect the process defective rate of product, scrap cost, rework cost, inspection cost, and the loss to the customer. There are considerable attentions paid to this work. The piecewise linear profit function of quality characteristic is usually applied in the filling/canning problem for determining the optimum manufacturing target, e.g., Carlsson [1], Golhar and Pollock [2], Misiorek and Barnett [3], and Lee, et al. [4,5], and so forth.

Carlsson [1] developed a method to determine the optimal process mean of normal quality characteristic of larger-the-better type. The net income takes production cost and different selling prices into account. He adopted the piecewise linear profit function to measure the net income. The manufacturer's income per item depends upon whether the product is accepted or rejected, reprocessed, or sold at a reduced price. If the product is an accepted item, the customer is willing to pay an additional price for good quality. If the product is a rejected item, the manufacturer may have to compensate the customer for bad quality, not only by reducing the price, but also by a price reduction proportional to the deficit in quality. The objective is to obtain the optimal process mean and maximize the expected net income per item.

Golhar and Pollock [2] considered a canning problem of normal quality characteristic which needs to determine the optimal mean and the upper limit of ingredient. The under-filled cans and overfilled cans are emptied and the ingredients are reprocessed. The objective in Golhar and Pollock's [2] model is to find the optimum value of the average weight and the maximum weight of the ingredients in a can that maximizes the expected profit per can. Misiorek and Barnett [3] proposed the modified Golhar and Pollock's [2] model with extra cost parameters. The overflowing material of filling is either recaptured or lost and the cost of the containers is considered. The under-filled container is top-

*Corresponding author. E-mail: chench@mail.stust.edu.tw