Economic Designs of Two-Sided Single and Double Screening Procedures

Min Koo Lee
Department of Business Administration, Seowon University,
Mochung-dong 231, Hungdok-gu Chongju, Chungbuk 360-742, Korea

Do Sun Bai
Department of Industrial Engineering, Korea Advanced Institute of Science and Technology, Gusung-dong 373-1, Yusung-gu Taejon, 305-701, Korea

Abstract

Due to advances in automated manufacturing systems and automatic inspection equipment, complete inspection of products is becoming an attractive alternative to acceptance sampling. Thus, 100% screening inspection procedures are widely used in industries to improving outgoing quality of products. In a screening inspection, all items are subject to acceptance inspection. If an item fails to meet the specifications, it is rejected and excluded from shipment. Often inspection with the 'performance variable' is destructive or expensive to measure, and it is not feasible to screen all items with the performance variable itself. Advances in testing equipment using X-ray, laser, ultrasound, etc., however, enable us to inspect items without destroying them by using 'screening variables' which are correlated with the performance variable.

In this paper, economic designs of single and double screening procedures for improving outgoing product quality based on two screening variables are presented for the case of two-sided specification limits. Two screening variables are observed simultaneously in the single screening procedure. In the double screening procedure, one variable is used first to make one of three decisions - accept, reject, or undecided - and after the first screening, the second variable is employed to screen the undecided items. It is assumed that the performance and the two screening variables are jointly normally distributed, and the deviation of the performance variable from the 'ideal' value causes dissatisfication to the consumers. Two quality cost functions - constant and quadratic - are considered. Cost models are constructed which involve screening inspection cost, and costs of accepted and rejected item. Methods of finding the optimal cutoff values are presented and a numerical example is given.

Results of numerical studies indicate that the expected profit tends to increase as the correlation coefficient between two screening variables increases, and correct use of quality cost function is important in designing a screening procedure.