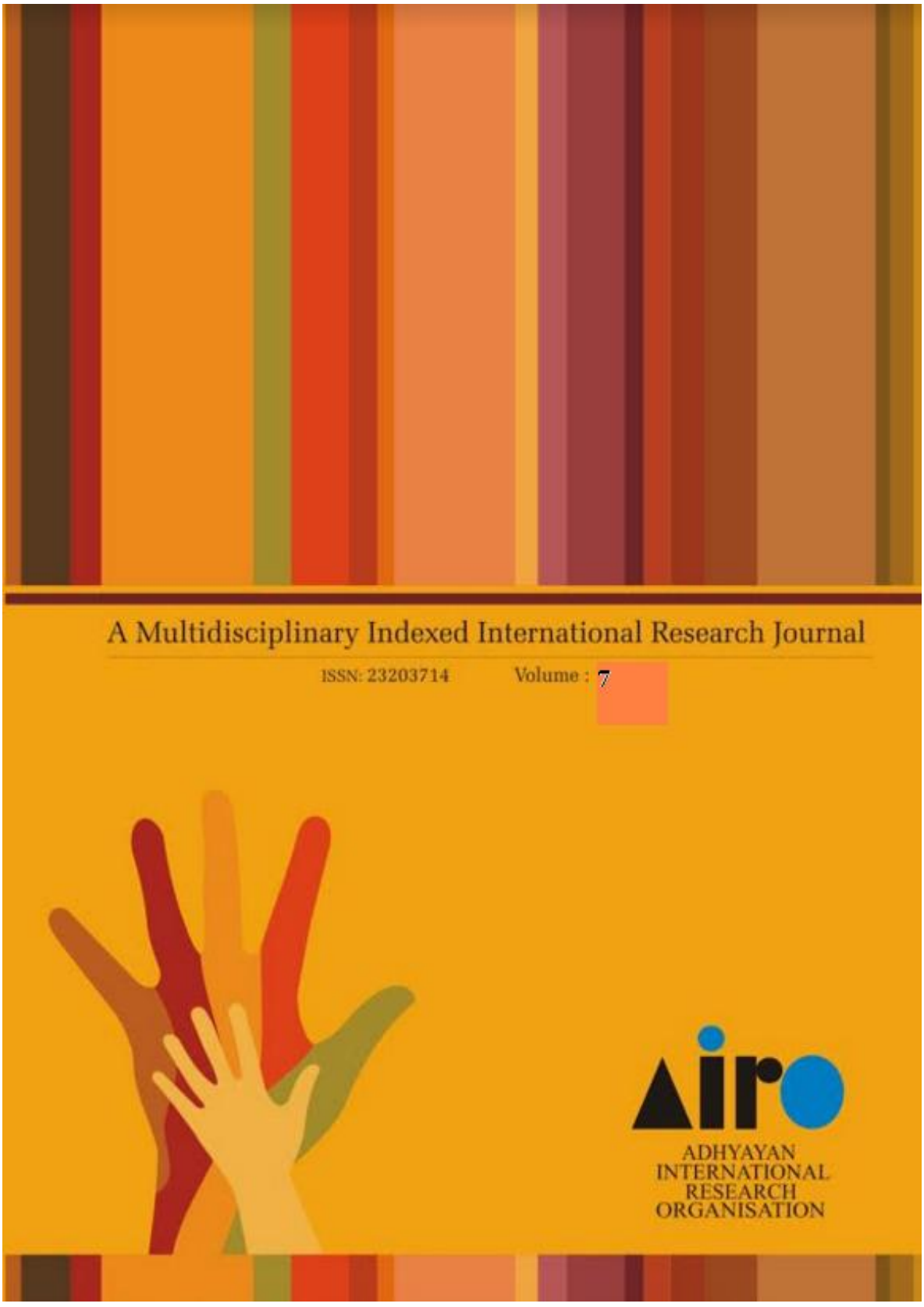
A Multidisciplinary Indexed International Research Journal
ISSN: 23203714
Volume : 7
Airo
ADHYAYAN
INTERNATIONAL
RESEARCH
ORGANISATION

A STUDY ON THE ROLE OF ATTRIBUTES AND VARIABLES IN THE SAMPLING INSPECTION PLANS

Sudesh Kumar[1], Dr. Manjeet Jakhar[2]

profsk@live.com, *dr.manjeet.jakhar@gmail.com*

[1]*Research Scholar of NIILM University, Kaithal, (Haryana) India,*

[2] *Assistant Professor, Department of Mathematics, NIILM University, Kaithal, (Haryana) India,*

ABSTRACT

Acceptance sampling is a branch of statistical quality control and is a methodology that deals with procedures by which decisions to accept or not to accept the lots are made based on the examination of sample items drawn randomly from the respective lots. Various inspection procedures, called sampling plans, are followed for drawing inferences about one or more lots of finished products based on the results of the inspection of one or more random samples drawn from the lot(s).

KEYWORDS:Sampling, Attribute, Parameters

INTRODUCTION

Sampling plans are classified into four major types namely, lot-by-lot sampling by attributes, lot-by-lot sampling by variables, sampling plans for continuous production and special purpose plans.

When the quality characteristic under consideration is an attribute, American National Standard Institute [1] the sampling plan that is used to make a decision on the disposition of the lots of manufactured products is known as lot-by-lot sampling by attributes. When th quality characteristic is measurable on a continuous scale. Army Chemical Center [2] the associated sampling plan is known as lot-by-lot sampling by variables. When production is continuous, the formation of lots for lot-by-lot inspection may be impracticable or some what artificial. Inspection procedures which have

been developed for such situations are termed as continuous sampling plans.

Balamurali, S., and Chi-Hyuck, J. [3] Special purpose plans are the sampling inspection procedures defined under the conditions that (a) the production is steady so that the results of past, current and future lots are broadly indicative of a continuing process, (b) the lots are submitted substantially in the order of their production; and (c) inspection is by attributes with quality defined in terms of a fraction nonconforming.

Brugger, R. M. A [4]A sampling plan is usually specified by one or more parameters such as sample size(s) and acceptance number(s), with which it is operated for making a decision on the lot. A sampling scheme or system is designated by a set of specifieds witching rules besides the sample size(s) and acceptance number(s). The discriminatory power of a sampling plan or a scheme or a system is revealed by its operating characteristic (OC) curve.

Burgess [5]Average outgoing quality limit, average sample number and average total inspection are other measures of assessing the performance of sampling plans. The determination of the parameters of a sampling plan or a scheme subject to certain conditions providing protection to the producer as well as to the consumer is called designing a sampling plan or scheme.

Calvin, T.W. TNT Zero [6] It is essential to ensure that the producer is protected from the rejection of the submitted lots which according to his production process are satisfactory ones and the consumer is safeguarded from receiving lots which consist of poor quality items.

Cameron, J. M. Tables [7]sampling plans should be generally derived with the objective of providing protection to the producer and the consumer.

Carr, W. E. [8]A common approach to design an acceptance sampling plan or scheme is to require that the corresponding OC curve should pass through two designated points, namely, acceptable quality level and limiting quality level associated with the producer’s risk and the consumer’s risk, respectively. These points would be considered to select the curve in accordance with a desired degree of discrimination.

Other criteria such as average outgoing quality limit, average sample number and

average total inspection are also followed in designing a plan or a scheme.

REVIEW OF RELATED LITERATURE

Schilling, *et al*., (2008) [9] presented a computer program in FORTRAN language to evaluate the OC function of single, double or multiple sampling plans by attributes and the percentage points of the probability of acceptance under the conditions of hyper-geometric, binomial, Poisson or normal distributions. The program also computes the measures such as the average sample number, the average outgoing quality limit and the average total inspection.

Nelson has given a computer program in BASIC language to compute the probabilities and cumulative probabilities of generalized binomial distribution wherebinomial and hyper-geometric distributions are special cases.

Peach discussed the problem of designing sampling inspection plans indexed by 1 *p* and 2 *p* with associated producer's risk and consumer's risk and suggested that the operating ratio, which is the ratio of 2 *p* to 1 *p* , can be used as a measure of discrimination while designing a plan. Grubbs discussed the problem of designing single sampling plans by attributes and constructed a table for two - point design of the plan.

Burgess presented a graphical method of determining a single sampling plan when it is required that its OC curve should pass through two designated points.

Hamaker and Army Chemical Center provided unity values for single and double sampling plans. Cameron adopted unity value approach under the conditions of Poisson model, and the operating ratio for determining the parameters of single sampling plans by attributes and for computing the points for the plot of associated OC curves.

Horsnell made use of approximation to Poisson model while computing the unity values for specified acceptance probabilities. Schilling provides a detailed account on the application of graphs, charts and nomo-graphs for selecting plans based on certain specified conditions. The important contributions on unity value approach and the operating ratio for designing sampling plans are found in Hald, Duncan, Sound arararjan ,Soundararajan and Govindaraju , and Schilling and Neubauer (2009).

Soundararajan et al. 2010 proposed a procedure for designing a single sampling plan indexed by AQL and AOQL in order to ensure protection to the producer and consumer.

Farnum (2009) [10] derived lower and upper bounds for average outgoing quality limit (AOQL) and found an approximation to AOQL in closed form and discussed the effect of *n* and *c* on AOQL and other performance measures of the plan under the conditions of binomial distribution.

Chakraborthy et al. 2012[11]has formulated the problem of determining a single sampling plan based on LQL as a stochastic programming problem under the conditions of Poisson distribution and proposed nonlinear integer programming approach for finding the solution when the process average and LQL are treated as random variables.

Govindaraju (2005)[12]proposed a procedure for finding a single sampling plan based on a point on the OC curve which corresponds to the lot of either good or bad quality and has established that such plans will be preferable when minimum average total inspection is of interest.

ANALYSIS AND RESEARCH WORK

Skip-lot sampling is a system of lot-by-lot sampling inspection plans in which a provision is made for inspecting a fraction of the submitted lots. The plans under this system are generally viewed as an extension and application of continuous sampling plan (CSP) to lots. Such types of plans are used when the quality of the submitted product is good as demonstrated by the producer's quality history. A specific skip-lot plan under its operation uses a given lot inspection plan by attributes called the reference sampling plan. Single, double and repetitive group sampling plans can be used as the reference plans under skip-lot sampling procedure.

Various procedures have been developed over the years and are employed for determining the parameters of sampling plans in such a way that they ensure protection to the producer and consumer. The unity value approach, which yields a value *np* by solving the equation related to the OC function of a sampling plan for a specified acceptance probability, is a commonly employed procedure when Poisson distribution is the underlying

distribution for the number of nonconformities in a sampled unit.

The Newton - Raphson's method of successive approximations or the method of iterations is used to find the unity values. A search procedure is a trial and error method, however, a logical reasoning methodology and is often employed when closed form expressions for the parameters do not exist. Extensive usage of computer programs simplifies the computation of quantities even when complicated mathematical expressions are given while determining the parameters of a sampling plan.

A few references with regard to computer programs in sampling inspection are cited here as examples. Snyder and Storer developed a computer program in FORTRAN to determine a single sampling plan by attributes under the conditions of Poisson distribution.

RESULT AND CONCLUTION

This research has focused on the designing aspects of lot-by-lot sampling by attributes and special purpose plans by attributes as well as variables for a prescribed set of requirements providing protection to the producer as well as the consumer. A detailed study on the evaluation of repetitive group sampling inspection plans, skiplot sampling plans with single sampling plan by attributes and by variables as the reference plans, skip-lot sampling plans with double and repetitive group sampling plans by attributes as the reference plans and tightened - normal - tightened sampling

schemes is made.

Repetitive group sampling (RGS) plans by attributes are compared with single and double sampling plans by means of the measure of discrimination, called operating ratio, so that their OC curves are identical. It is found that the RGS plans are more efficient and economical. The matched sets of single, double and RGS plans using unity values are arrived and listed. Based on the properties of OC curves a searching algorithm is developed for deriving optimum RGS plans corresponding to two specified points on the OC curve providing protection to the producer and the consumer.

REFERENCES

1. American National Standard Institute/American Society for Quality Control(ANSI/ASQC) Standard A2 .*Terms, Symbols and Definitions*

forAcceptance Sampling, American Society for Q uality Control, Milwaukee,Wisconsin, US.

2. Army Chemical Center. *Master Sampling Plans for Single, Duplicate, Doubleand Multiple Sampling*, Manual No. 2, United States Department of Army,Chemical Corps Engineering Agency, US.
3. Balamurali, S., and Chi-Hyuck, J. (2006). Repetitive Group Sampling Procedure forVariables Inspection, *Journal of Applied Statistics*, 33(10), pp. 327 - 338.
4. Brugger, R. M. A Simplification for Skip-lot Procedure Formulation, *Journalof Quality Technology*, 7(4), pp. 165 - 167.
5. Burgess. A Graphical Method of Determining a Single Sampling Plan,*Industrial Quality Control*, 4(6), pp. 25 - 27.
6. Calvin, T.W. TNT Zero Acceptance Number Sampling, *American Society forQuality Control Annual Technical Conference Transactions*, Philadelphia, PA,pp. 35 - 39.
7. Cameron, J. M. Tables for Constructing and for Computing the OperatingCharacteristics of Single Sampling Plans, *Industrial Quality Control*, 9(1),pp. 37 - 39.
8. Carr, W. E. Sampling Plan Adjustment for Inspection Error and Skip-lotPlans, *Journal of Quality Technology*, 14(3), pp. 105 - 116.
9. Schilling, (2008) presented a computer program in FORTRAN language to *Journal of Applied Statistics*, 95(32), pp. 654 - 660.
10. Farnum (2009) derived lower and upper bounds for average outgoing quality limit (AOQL) *Industrial Quality Control*, 6(99), pp.125 -127.
11. Chakraborthy et al. 2012 [11] has formulated *Industrial Quality Control*, 13(9), pp. 937 - 939.
12. Govindaraju (2005) [12] proposed *Journal of Quality Technology*, 104(66), pp. 705 - 716.