

## REVIEW OF LITERATURE

Continuous sampling plans were developed when the product units are manufactured by a conveyor belt or other straight line system with units flowing one after another in progressive assembly such that the formation of lots for lot-by-lot acceptance may be impracticable and/or artificial. Dodge (1943) introduced the concept of continuous sampling plan and provided the mathematical rationale and the rules of operation for first continuous sampling plan designated as CSP-1.

The basic CSP-1 procedure has been modified to formulate a number of real life situations in the following plans. Dodge and Torrey (1951) introduced CSP-2 plan and CSP-3 plan where screening inspection is delayed and resumed only when one defect falls too closely on the heels of another during sampling and to provide extra protection against spotty quality respectively, CSP-R plan of Benzhaf and Brugger(1970) to incorporate normal-tightened-reduced inspection concept and CSP-V of Aasheim (1972) to achieve reduced inspection with smaller clearance interval. White (1961) presented a graphical method to determine the parameters of CSP-1 sampling plan.

Wang and Chang (1989) designed a new continuous sampling plan to be used when the production rates are high without reverting to screening inspection. CSP-C of Kandasamy and Govindaraju (1991) is an extension of CSP-1 characterized by a maximum allowable number of nonconforming units  $c$ . Using Markov chain model, performance measures of CSP-C are derived. Muthulakshmi (1999) proposed tightened CSP-1(C) plan, a modified form of CSP-1 and derived performance measures using simplified Markov chain approach.

Roberts (1965) proposed a new method of finding the steady state probabilities of CSP-1 by using Markov-chain technique and derived AOQ function. Endres(1969) derived an expression for the UAOQL under non-rectifying inspection.

Blackwell (1977) obtained an approximation for AFI and derived measures of effectiveness. Stephens(1981) analyzed the consumer protection of CSP-1 plan.

The major developments of sampling inspection procedures for continuous production process from an economic point of view are reviewed by Chiu and Wetherill (1973). Yang (1983) presented a renewal process approach to derive performance measure of CSP-1. Gowrishankar and Mohapatra (1994) developed GERT analysis for CSP-1 plan.

Hillier (1964) in his article criticized the independently and identically distributed (iid) Bernoulli assumption of CSP-1 plan. Lasater (1970) obtained the robustness of a class of continuous sampling plans under certain types of process models. Bidjarono and Wasmuth (1976) employed the model to describe the quality of successively manufactured rolls of photographic film in which the identically and independently distributed Bernoulli case is a special case.

Rajarshi and Kumar(1983) and Kumar and Rajarshi (1987) proposed an intermediate model in which the quality fluctuates between two levels with the qualities of successive items form a two-state time homogenous Markov-chain. Using the theory of runs, the authors obtained expressions for the AOQ under rectifying inspection to monitor the quality of a glass bottle moulding process.

Mcshane and Turnbull (1991) investigated the performance of CSP-1 when the input process is not identically and independently distributed Bernoulli. Muthulakshmi and Devi (2012) developed CSP-1 for a systematically varying process.

. Chen and Chou (2000) discussed the problem of determining cost-optimal CSP-1 plan when quality fluctuates between two levels according to a two-state time homogeneous Markov chain. Cassady et.al. (2000) proposed an economic model of the CSP-1 using Demings's Kp rule. Chen et. Al. (2001) discussed the minimization of average fraction inspected for the tightened CSP-1 plan. Haji and Haji (2004) derived the total cost and minimum cost policy for one of the most commonly used

CSP-1. Farmakis et al. (2007) examined the economic performance of CSP-1 under a specified AOQL with linearly varying acceptance cost.

Balamurali and Jun (2004) presented the average outgoing quality limit for CSP-T sampling procedures for continuous production processes. Bebbington et.al. (2003) explored the designing of a continuous sampling plan when it is not possible to inspect the units of production unit by unit in the long run and studied the impact of correlation in the production process.

Balamurali and Subramani (2004) reviewed the consumer protection of Modified CSP-C continuous sampling plan. Balamurali and Jun (2006) derived the formulas using the renewal theory approach enabling one to compute AOQ and AFI for CSP-C for both long run and short run production processes.

The variations or generalizations of the CSP-1 plan basically aim at reducing the inspection effort by introducing more than one sampling level or frequency or a reduced clearance number. Lieberman and Solomon (1955) considered multilevel plan which allows for smoother transition between sampling inspection and screening inspection as an extension of continuous sampling plan, CSP-1.

Derman, Littauer and Solomon (1957) presented three generalizations to the plan of Lieberman and Solomon (1955). The tightest of the three plans is designated as MLP-T. The main advantage of the tightened continuous sampling plans is that of lowering the average outgoing quality limit. Fordice (1972) proposed the tightened multilevel continuous sampling plan CSP-T.

Kandasamy and Govindaraju (1993) presented the selection of tightened two level continuous sampling plan. Muthulakshmi (1999) designed the generalized tightened two level and three level continuous sampling plans and derived performance measures using simplified Markov chain approach. Chen (2004) explored the problem of minimizing the average fraction inspected (AFI) for a modified MLP-T-2 plan and developed the plan to find the optimal parameters that will meet the average outgoing quality limit (AOQL) requirement, and minimum AFI.

Balamurali and Govindaraju (2000) proposed a modification to the tightened two level continuous sampling plan. Balamurali and Kalyanasundaram (2000) generalized the tightened two level continuous sampling plan.

Further, Guayjarernpanishk and Mayureesawan (2012a) presented the concept of modified two-level continuous sampling plan and compared with modified CSP-C. Guayjarernpanishk and Mayureesawan (2012b) presented the design of two level continuous sampling plan MCSP-2-C. Single and multilevel continuous sampling procedures and tables for inspection by attributes are given in MIL-STD-1235 C (1988). Mytalas et. al. (2010) analyzed the performance of CSP-1, CSP-2, CSP-C and tightened multi-level plans under the assumption that the quality of the examined parts exhibits Markovian dependence. They also presented a method for computing the exact probability generating function for the joint number of items of the continuous inspection phase and the sampling inspection phase using Markovian analysis.

Karlin (1966) and Parzen (1962) provided the description of the stochastic process by means of states and transitions and showed their properties. Stephens (1979) suggested the suitability of continuous sampling plans and presented elaborately various types of continuous sampling plans with their performance measures. A detailed review and a listing of the operating procedures of various continuous sampling plans available in the literature may be seen in Stephens (1995).

Modern production processes, particularly those occurring in the electronics industry, are of high quality when the fraction of nonconforming products is in the range of parts per million. Pesotchinsky (1987) proposed a strategy combining the best features of continuous sampling plan, CSP-1 of Dodge (1943) with the lot by lot inspection plan.

Bebbington and Govindaraju (1998) provided exact mathematical results and derivation of performance measures for Pesotchinsky's scheme. Due to the complexity of Pesotchinsky's scheme, Govindaraju and Bebbington (2000) proposed

a simplified scheme called combined continuous lot by lot acceptance sampling plan and derived its performance measures, using the Markov chain approach of Stephens (1995).

Govindaraju (1989) matched CSP-1 plan and single sampling plan on the basis of outgoing quality and long run probability of acceptance. Wasserman (1990) derived a model to relate the plan performance between CSP-1 plan and single sampling plan of lot inspection.

Chung-Ho Chen (2004) investigated the minimum average fraction inspected which guarantee the specified average outgoing quality limit. Chung-Ho Chen (2011) presented the economic selection of quality investment for designing a combined continuous lot by lot acceptance sampling plan with average outgoing quality limit protection.

Vijayaraghavan and Aruna (2014) discussed the properties of combined plans with single sampling plan as reference plan and presented procedure for determining the plan parameters by providing protection simultaneously to the producer and the consumer.