# ABSTRACT

The auxiliary information may be used in the design or inference stage in the sampling survey. The proper utilization of the auxiliary information, which would be obtained during the survey as well as the primary information, has been an important issue in the history of survey sampling. Ratio estimators are widely used estimators that utilizes the data from the variable of interest $y$ together with that form of auxiliary variable $x$ for better inference of the population quantity of interest.

Adaptive Cluster Sampling (ACS) is an untraditional data-driven sampling selection scheme and an alternative method to estimate the population of interest quantity especially under a rare or clustered populations. ACS first proposed by Thompson (1990) and its different designs have been proposed by (Thompson and Seber 1996, Salehi and Seber 1997, Chirstman 2003), and it has been used in different disciplines, such as Ecological Science, Environmental Science, Geographical and social Science. Two phase and sampling are the concepts associated in estimation of population mean from finite population under different cases of availability or non-availability of auxiliary information. Kajee Lee (1998) and Felix-Medina (2000) have presented the two phase ACS schemes and closed-form expressions for the Rao-blackwell estimators based on the modified Hansen-Hurwitz estimator and the modified Horvitz-Thompson estimator. In this study we have proposed some new modified estimators in ACS design at second phase motivated by the need for efficiency in surveys of rare and clustered populations. Our estimators are modification and extension of some available estimator in literature.

Two generalized Ratio Type Exponential Estimators with single auxiliary variable are proposed motivated from Shahzad, 2014 and Upadhyaya et al. in 2009 along with several others proposed estimators with their families in which some are the special cases of our generalized estimators are presented. We have derived the expressions of MSEs and biases of all the proposed estimators also presented the families of generalized estimators. After conducting the empirical study using the R-language statistical software, have shown the situations in which MSE may be reduced by increasing the sample size at second phase, instead of first phase for study of rare and clustered population. Hence, this study is initiative towards the 2$^{nd}$ phase ACS.