Technical Methodology Note

The Pulso Sampling and Estimation Framework

Quota-Controlled Panel Sampling and Calibration Weighting
for National and Local Survey Estimates

(Version 1.0, Initial Methodological Framework)

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Abstract

This paper documents the sampling and estimation methodology developed for use by Pulso Intelligence Labs, Inc. ("Pulso Intelligence") to select survey respondents from its respondent panel and to produce national and local survey estimates. The methodology combines quota-controlled sampling across Sex $\times$ Region cells with a two-component weighting procedure: calibration to official registered voter counts published by the Philippine Statistics Authority (PSA), and a propensity adjustment that corrects for differences between the composition of the panel and that of the target population. The paper sets out the sampling algorithm, the weight computation algorithm, the estimation procedure, and the validation framework, together with the reporting standards and thresholds that govern the publication of results.

This Version 1.0 document presents the initial statistical framework developed for Pulso Intelligence. Its procedures are intended for implementation, testing, validation, and continuing refinement using actual survey data and suitable external benchmarks.

1. Purpose

This paper presents the methodology developed for implementation by Pulso Intelligence to select survey respondents from its respondent panel and to produce more reliable national survey estimates. Because the benchmark data presently available consist only of official voter counts by sex and region, the methodology focuses on selecting respondents through quota-controlled sampling and on improving the representativeness of survey results through calibration weighting.

The methodology is designed to be transparent and reproducible. It specifies how respondents are drawn, how survey results are adjusted to reflect the target population, and how the credibility of the resulting estimates is assessed. Documenting these procedures in a single reference allows the assumptions behind any Pulso Intelligence estimate published under this framework to be examined and independently evaluated.

2. Components of the Methodology

The methodology comprises four components: the sampling algorithm, which governs the selection of survey respondents from the panel; the weighting algorithm, which adjusts survey results to better reflect the target population; the estimation procedure, which produces national and local estimates from weighted responses; and the validation framework, which tests whether the resulting estimates provide a credible representation of the target population.

Taken together, these components describe the overall statistical approach, set out the step-by-step operational workflow, and provide the procedures needed to apply the methodology consistently across different survey and polling activities.

3. Workflow

3.1 Sampling Algorithm

Input: Active Pulso Intelligence panel members, desired sample size.

Step 1: Remove duplicate, inactive, and invalid accounts.

Step 2: Group verified panel members into Sex (Male, Female) × Region (18 regions) cells.

Sex / Region	1	2	...	16	17	18
Male						
Female						

Step 3: Choose 1000 panel members per cell, ideally. (May vary depending on the availability on each cell. Can be 500, 400, ..., 200)

Step 4: Send survey invitations and monitor quota completion.

Output: Final respondent sample.

3.2 Weight Computation Algorithm

Input: Completed Pulso Intelligence survey responses and the official number of registered voters by Sex × Region (e.g., probability-based survey, PSA microdata, COMELEC-related benchmark data)

3.2.1 Computation of the PSA Weight

Step 1: Group all completed survey respondents according to their corresponding Sex × Region category (cell) and determine the total number of completed respondents within each cell. This provides the observed distribution of the survey respondents.

Step 2: Obtain the official number of registered voters for each corresponding Sex × Region cell from the Philippine Statistics Authority (PSA). These official counts serve as the benchmark that the survey results will be aligned with.

Step 3: For each Sex × Region cell, compute the calibration weight as

$$w_c = \frac{N_c}{n_c} \tag{1}$$

where N_c is the official voter population for cell c and n_c is the number of completed Pulso Intelligence respondents in cell c. The calibration weight indicates how much each respondent represents in the target population. Respondents from underrepresented groups receive larger weights, while those from overrepresented groups receive smaller weights.

Example. Suppose the official voter population for males in Region IV-A is 100,000, while only 500 completed survey responses were obtained from that group.

The calibration weight is

$$w_c = \frac{100{,}000}{500} = 200.$$

This means that each respondent from that group represents approximately 200 registered voters in the weighted analysis.

Step 4: Assign the computed calibration weight to every respondent belonging to the corresponding Sex × Region cell so that all respondents within the same cell receive the same weight.

Step 5. Store the calibration weight assigned to each respondent. These weights should be applied consistently to all survey questions within the same survey wave to generate weighted national and local estimates.

Step 6. Using the final respondent weights, calculate the effective sample size

$$n_{\text{eff}} = \frac{\left(\sum_i w_i\right)^2}{\sum_i w_i^2}. \tag{2}$$

The effective sample size measures how much statistical information remains after weighting. Because weighting gives more influence to some respondents than others, the effective sample size is often smaller than the actual number of completed interviews. This value should be reported together with the survey results to help users interpret the precision of the estimates.

3.2.2 Computation of the Propensity Adjustment Weight

Step 1: Prepare two datasets: (1) the completed Pulso Intelligence survey respondents and (2) a reference dataset that represents the target population. The reference dataset serves as the benchmark against which the Pulso Intelligence respondents will be compared. It may come from a probability-based survey, Philippine Statistics Authority (PSA) microdata, COMELEC-related data, or another credible national data source. Both datasets should contain the same set of auxiliary variables such as age group, sex, region, educational attainment, urban-rural classification, and income class to ensure that respondents can be compared consistently across the two datasets.

Step 2: Create a source indicator variable S_i for each observation, where

$$S_i = \begin{cases} 1, & \text{if respondent } i \text{ comes from the Pulso Intelligence survey sample} \\ 0, & \text{if respondent } i \text{ comes from the reference population dataset} \end{cases}$$

Step 3: Combine the Pulso Intelligence survey dataset and the reference dataset into one pooled dataset. The combined dataset will be used to estimate the likelihood that a respondent with a given profile belongs to the Pulso Intelligence panel rather than the reference population.

Step 4: Estimate a propensity score model using the source indicator S_i as the outcome variable and the common auxiliary variables as predictors. For example, the model may be specified as

$$\begin{aligned} \operatorname{logit}[P(S_i = 1 \mid X_i)] = \alpha &+ \beta_1 \,\text{Age}_i + \beta_2 \,\text{Sex}_i + \beta_3 \,\text{Region}_i + \beta_4 \,\text{Education}_i \\ &+ \beta_5 \,\text{Urban}_i + \beta_6 \,\text{Income}_i + \cdots \end{aligned} \tag{3}$$

where X_i represents the set of observed characteristics used to explain the likelihood of belonging to the Pulso Intelligence sample.

Step 5: For each Pulso Intelligence respondent, obtain the predicted probability from the propensity score model:

$$\hat{p}_i = \frac{\exp(\hat{\eta}_i)}{1 + \exp(\hat{\eta}_i)} \tag{4}$$

where

$$\begin{aligned} \hat{\eta}_i = \hat{\alpha} &+ \hat{\beta}_1 \,\text{Age}_i + \hat{\beta}_2 \,\text{Sex}_i + \hat{\beta}_3 \,\text{Region}_i + \hat{\beta}_4 \,\text{Education}_i + \hat{\beta}_5 \,\text{Urban}_i + \hat{\beta}_6 \,\text{Income}_i \\ &+ \cdots \end{aligned} \tag{5}$$

Step 6: Compute the propensity adjustment weight for each Pulso Intelligence respondent as

$$w_{\text{propensity},i} = \frac{1}{\hat{p}_i} \tag{6}$$

Respondents who are well represented in the Pulso Intelligence panel will generally receive smaller weights because many similar respondents are already included in the survey. In contrast, respondents who represent groups that are less well represented in the Pulso Intelligence panel will receive larger weights so that these groups contribute appropriately to the final survey estimates.

Step 7: To avoid unstable estimates caused by very large weights, apply weight stabilization or trimming. A stabilized propensity weight may be computed as

$$w^{\text{stable}}_{\text{propensity},i} = \frac{P(S = 1)}{\hat{p}_i} \tag{7}$$

where $P(S = 1)$ is the overall proportion of observations in the pooled dataset that came from Pulso Intelligence. Extreme weights may also be capped at a chosen percentile, such as the 95th or 99th percentile.

3.2.3 Final Weights Computation

Step 1: Store the resulting propensity adjustment weight for each Pulso Intelligence respondent. This weight reflects how likely a respondent is to belong to the Pulso Intelligence panel relative to the target population. To obtain the final weight used in survey estimation, the propensity adjustment weight is combined with the PSA calibration weight. Together, these two components help adjust for differences between the Pulso Intelligence panel and the target population while also accounting for the quality of the survey responses. The final respondent weight is computed as:

$$w_i = w_{\text{PSA},i} \times w_{\text{propensity},i} \tag{8}$$

Step 2: Apply the final respondent weights consistently to all survey questions within the same survey wave. Using the same set of weights across all analyses ensures that every survey estimate is based on the same representation of the target population, resulting in consistent and comparable weighted national and subnational estimates. For any survey outcome $\hat{Y}_i$, the weighted estimate is computed as

$$\hat{Y}_i = \frac{\sum_{i=1}^{n} w_i y_i}{\sum_{i=1}^{n} w_i} \tag{9}$$

Step 3: Using the final respondent weights, calculate the effective sample size as

$$n_{\text{eff}} = \frac{\left(\sum_{i=1}^{n} w_i\right)^2}{\sum_{i=1}^{n} w_i^2} \tag{10}$$

The effective sample size indicates how much useful statistical information remains after the weighting process. Because weighting gives more influence to some respondents than others, the effective sample size is often smaller than the actual number of completed survey responses. Reporting the effective sample size together with the survey results helps users better understand the reliability and precision of the reported estimates.

Output: Respondent-level calibration weights, Weighted survey dataset, Effective sample size

Assumptions:

1. Official voter counts by Sex × Region are accurate and current.
2. Every respondent belongs to exactly one Sex × Region cell.
3. All respondents within a cell are assigned the same calibration weight.
4. The weighted sample is intended to reduce demographic imbalance but does not eliminate all sources of selection bias inherent in a nonprobability panel.

3.3 Estimation Algorithm

Input: Respondent-level calibration weights, Survey responses for the variable of interest

Step 1: Identify the survey question or variable to be estimated (e.g., candidate preference, approval rating, issue awareness, or policy support).

Step 2: For each respondent, retrieve the corresponding calibration weight computed using the weight computation algorithm in Section 3.2.

Step 3: Calculate the weighted estimate using

$$\hat{Y} = \frac{\sum_{i=1}^{n} w_i y_i}{\sum_{i=1}^{n} w_i} \tag{11}$$

where y_i is the response of respondent i, w_i is the calibration weight of respondent i and $\hat{Y}$ is the estimated population proportion or weighted mean. Note that for categorical questions, compute the weighted proportion separately for each response category.

Step 4: Subnational estimates, such as those for provinces, cities, municipalities, or districts, should only be produced when there are enough completed survey respondents from the target area and official population data are available for that locality. Having an adequate number of respondents and reliable population benchmarks ensures that the weighting process can be applied correctly and that the resulting estimates are sufficiently reliable for reporting.

For regional estimates, the estimation procedure may be applied using only the respondents from the selected region, provided that both the actual sample size and the effective sample size are adequate. As a practical guideline for this methodology, an effective sample size of at least 100 is recommended to help ensure that the resulting regional estimates are sufficiently stable and reliable for reporting.

For provincial, city, district, or municipal estimates, separate calibration weights should ideally be developed using the official voter population counts for the specific locality being surveyed. At a minimum, official population counts by sex should be available for the target geographic area to support the weighting process. If more detailed population information such as age group, educational attainment, or urban-rural classification is available, these should also be incorporated into the weighting procedure to further improve the representativeness and accuracy of the survey estimates.

The local calibration weight may be computed as

$$w_{c,g} = \frac{N_{c,g}}{n_{c,g}} \tag{12}$$

where g is the target geographic area, c is the calibration cell, such as sex, $N_{c,g}$ is the official voter population in cell c within area g; and $n_{c,g}$ is the number of completed Pulso Intelligence respondents in the same cell and area.

Local estimates shall then be computed as

$$\hat{Y} = \frac{\sum_{i=1}^{n} w_{i,g} y_i}{\sum_{i=1}^{n} w_{i,g}} \tag{13}$$

Step 5: Present the weighted estimates together with the effective sample size, sample size, weighting variables used, and fieldwork period.

Output: Weighted national estimate, Weighted local estimates (when applicable), Effective sample size.

Note: Local survey estimates should not be published when the effective sample size is below 100, unless the results are clearly identified as exploratory or preliminary. When the effective sample size is too small, the resulting estimates may become unstable and less reliable for decision-making. The minimum threshold of 100 is a reporting guideline established to promote consistency and is not a universal statistical requirement. As additional survey data become available and the methodology is validated, this threshold may be refined. While the methodology can be applied to both national and local surveys, producing reliable local estimates also requires the availability of the appropriate official population data for the target locality.

3.4 Validation

The methodology is to be validated after each survey wave to ensure that the weighted survey results continue to provide a credible representation of the target population. Validation helps determine whether the weighting procedure has successfully reduced differences between the Pulso Intelligence respondent panel and the target population, and whether the resulting estimates remain stable and reliable over time.

At a minimum, the weighted distribution of respondents should be compared with the official Philippine Statistics Authority (PSA) voter population by Sex $\times$ Region. This comparison verifies that the calibration weights have adjusted the survey results to closely reflect the demographic composition of the target population.

Whenever appropriate, election-related survey estimates should also be compared with official election results, reputable national surveys, or historical survey trends. These comparisons provide additional evidence on the accuracy, consistency, and stability of the methodology and help identify areas where further refinement may be needed.

To promote transparency and enable users to properly interpret the survey results, every survey report should disclose the achieved sample size, effective sample size, weighting variables used, fieldwork period, and any known methodological limitations. Providing this information allows users to better understand how the estimates were produced and the level of confidence that can reasonably be placed in the results.

3.5 Reporting of Statistical Uncertainty and Methodological Limitations

The Pulso respondent panel is a nonprobability panel because membership in the platform is not determined through probability sampling from the entire target population. Consequently, conventional design-based margins of sampling error and confidence intervals should not be reported or interpreted in the same manner as those from a probability sample.

Survey reports shall instead disclose the achieved sample size, effective sample size, weighting variables, geographic coverage, fieldwork period, validation results, and relevant methodological limitations. Where model-based or resampling measures of uncertainty are subsequently developed, the procedures, assumptions, and interpretation of these measures shall be clearly documented.

The effective sample size reflects the loss of statistical information resulting from unequal respondent weights. It does not measure or eliminate all possible sources of error, including coverage error, nonresponse error, measurement error, and residual selection bias arising from unobserved differences between Pulso respondents and the target population.

Weighted estimates should therefore be described as calibrated estimates derived from a nonprobability respondent panel and should be interpreted together with the disclosed validation results and methodological limitations.

The following standard disclosure shall accompany every report or release of results:

> *Results are based on a calibrated nonprobability respondent panel. Estimates are weighted using available official population benchmarks. Conventional design-based margins of sampling error are not reported because respondents were not recruited through probability sampling from the full target population.*

4. Method Implementation

The methodology is designed to serve as the standard operating procedure of Pulso Intelligence for conducting national and local surveys using its respondent panel. For each survey, the process begins by clearly defining the survey objectives, identifying the target population, determining the desired sample size, and obtaining the official voter population counts needed for sample allocation and weighting.

Once these requirements have been prepared, survey respondents are selected using the sampling algorithm described in this paper. After data collection, the completed survey responses undergo data cleaning to remove incomplete, duplicate, or invalid records before respondent-level calibration weights are computed using the prescribed weighting procedure. These weights are then applied to generate weighted national or local survey estimates that better reflect the target population.

Before survey results are released, the weighted estimates are to be validated against the appropriate official population data and other available benchmark sources to verify their reliability. Following this same workflow for every survey wave promotes consistency, transparency, and reproducibility, while ensuring that all survey results are produced using a standardized and well-documented statistical methodology.

5. Scope and Current Status

This paper documents the statistical methodology developed for application by Pulso Intelligence to national and local surveys conducted through its respondent panel. It covers the conceptual framework, the respondent sampling procedure, the weighting methodology, the estimation procedure, the validation process, and the implementation workflow. Together, these components establish a standardized approach intended to be applied consistently across survey and polling activities.

This Version 1.0 document presents the initial statistical framework developed for Pulso Intelligence. Its procedures are intended for implementation, testing, validation, and continuing refinement using actual survey data and suitable external benchmarks.

Two qualifications should be noted. First, the calibration procedure described here is presently constrained by the benchmark data available: official counts of registered voters by sex and region. Where more detailed official population data become available, whether by age group, educational attainment, urban-rural classification, or income class, these variables can be incorporated into the calibration and propensity models to improve the representativeness of the estimates. Second, the propensity adjustment component depends on access to a suitable reference dataset drawn from a probability-based survey, PSA microdata, or another credible national source. Where no such reference dataset is available for a given survey wave, estimates rely on the PSA calibration weight alone, and reports should disclose this.

Planned enhancements include an automated weighting and estimation tool, implementation-ready formulas, and empirical validation of the methodology against completed survey waves and official election results. These enhancements depend on the availability of the corresponding datasets and are intended to move the methodology from a documented statistical framework to a fully operational and automated survey system.

Once fully implemented, the methodology provides a standardized, transparent, and statistically sound framework for conducting national and local surveys, enabling Pulso Intelligence to generate more credible survey estimates while continuously improving the methodology through validation and future data enhancements.

6. Versioning and Disclaimer

This document constitutes Version 1.0 (Initial Methodological Framework) of the Pulso Sampling and Estimation Framework, dated July 15, 2026. Pulso Intelligence Labs, Inc. reserves the right to update, change, and revise the current version of this paper at any time as the methodology undergoes implementation, testing, validation, and continuing refinement. Any subsequent version issued by Pulso Intelligence Labs, Inc. supersedes this document, and readers should confirm that they are consulting the most recent version before relying on its contents.

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