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COMPARATIVE ANALYSIS OF SIMPLE RANDOM SAMPLING AND MULTI-STAGE SAMPLING IN ESTIMATING NATIONAL UNEMPLOYMENT RATE

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ABSTRACT

This study analyzes the comparative effectiveness between Simple Random Sampling (SRS) and Multi-Stage Sampling methods in estimating the national unemployment rate in Indonesia. Measuring macroeconomic indicators such as the Open Unemployment Rate (TPT) requires high precision but is often constrained by vast geographical coverage and budget limitations. The primary data used is from the National Labor Force Survey (Sakernas) February 2026, which recorded a TPT of 4.68%, a decrease from 4.76% in February 2025. This study also reviews the theoretical foundations of statistical inference, including the use of 95% confidence intervals and the Design Effect (Deff) concept. The results show that although SRS offers an unbiased theoretical basis with minimum variance in homogeneous populations, the Multi-Stage Sampling method applied by the Central Bureau of Statistics (BPS) proves to be far more efficient logistically and cost-wise for a national population spread across 514 districts/cities. The study concludes that the use of staged sampling is able to suppress nonsampling errors through concentrated field supervision without significantly compromising data reliability, making it the standard method for macroeconomic policy.

Keywords: Unemployment, Simple Random Sampling, Multi-Stage Sampling, Sakernas 2026, Design Effect, Statistical Efficiency.

INTRODUCTION

Statistics in the field of economics serves to transform the uncertainty of sample data into statements with strong logical foundations regarding the population. One of the main challenges for the government is determining unemployment figures accurately to guide national development policies. Measurement of macroeconomic indicators like the Open Unemployment Rate (TPT) requires high precision but is often hindered by the vast geographical scope and limited resources. Data as of February 2026 shows that the labor force in Indonesia reached 154.91 million people, of whom 7.24 million were still unemployed. The decrease in the number of unemployed people by 35 thousand compared to February 2025 requires precise periodic monitoring.

Conducting a complete census of the entire population every month is an unrealistic task because it takes a very long time and is very expensive. History records the failure of the US presidential election prediction by the *Literary Digest* in 1936 caused by bias in sample selection, which confirms that data reliability depends on the sampling method, not just the amount of data (Wonnacott & Wonnacott, 1984). Therefore, sampling techniques become crucial instruments. The fundamental problem in national surveys is choosing a

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method capable of reaching a widely scattered population while maintaining the desired level of precision and minimizing administrative errors. This study aims to compare the effectiveness of Simple Random Sampling (SRS) and Multi-Stage Sampling in the context of the 2026 Sakernas data, providing a comprehensive analysis of why modern statistical agencies prefer complex designs over simple randomization for large-scale economic indicators.

LITERATURE REVIEW

Simple Random Sampling (SRS)

SRS is the most basic method where every member of the population has an equal chance of being selected. Conceptually, this is likened to putting everyone's name into a large container, mixing them, and drawing a number of chips randomly. Mathematically, every observation in SRS has the same population probability distribution ($p(x)$). The advantage of SRS is that the procedure is easy to understand and can reduce bias if the population is homogeneous. However, SRS requires a complete list of all population members (*sampling frame*) which is difficult to provide on a national scale. Furthermore, pure SRS is often "very slow and expensive" because interviewers must reach individuals in isolated locations (Wonnacott & Wonnacott, 1984). In the context of national unemployment estimation, the lack of a centralized, up-to-date list of every working-age individual makes SRS operationally prohibitive.

Multi-Stage Sampling

This method performs sampling in stages, usually starting from large cluster levels (such as provinces or districts) down to the smallest units such as households or individuals. This technique is a development of *cluster sampling* aimed at increasing the efficiency of research on complex social problems. The US Census Bureau uses this multistage combination in the *Current Population Survey* (CPS) to measure monthly unemployment. In Indonesia, the Central Bureau of Statistics (BPS) applies it in Sakernas through stages of identifying census blocks to households (Badan Pusat Statistik, 2008). The process typically involves selecting Primary Sampling Units (PSUs) such as census blocks, followed by Secondary Sampling Units (SSUs) like households, and finally individuals within those households. This hierarchical approach allows for geographic concentration of data collection efforts.

Comparison of Accuracy and Design Effect

Theoretically, SRS provides the most efficient estimate with minimum variance for the same sample size if the population is homogeneous. However, for large and heterogeneous populations, Multi-Stage Sampling (often combined with stratification) can produce a more representative sample. Precision in staged sampling is assessed through the

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calculation of the *Design Effect* (Deff), which shows the ratio of the variance of the method used to the variance of SRS. The Deff formula is expressed as:

$$\text{Deff} = 1 + \rho(m - 1)$$

Where ρ is the inter-cluster correlation coefficient (*rate of homogeneity*) and $m$is the number of sample units per cluster. If Deff > 1, then a larger sample size is needed to obtain precision equivalent to SRS. According to *Introductory Statistics for Business and Economics*, there is no single complex formula specifically only for multi-stage sampling in early chapters. Instead, the book explains that in large-scale surveys, the Simple Random Sampling (SRS) formula is used as a very good approximation because the accuracy level of multi-stage sampling is often almost the same as SRS (Wonnacott & Wonnacott, 1984). This approximation is valid when the sampling fraction is small and the clusters are well-defined.

METHODS

This study uses a descriptive-inferential comparative approach utilizing secondary data from BPS and statistical theoretical foundations.

Population and Sample The study population is the entire Working Age Population (PUK) in Indonesia, numbering 219.54 million people in February 2026. The sample size analyzed covers 30,780 Local Environment Units (SLS) or approximately 307,800 households for annual estimates. In the supporting theoretical context, simulation data with a large sample size ($n = 100{,}000$) was also analyzed to calculate confidence intervals, mirroring the scale of major international surveys like the US CPS.

Data Sources Primary data comes from Official Statistics News (BRS) No. 49/05/Th. XXIX regarding the Indonesian Labor Situation in February 2026. Supporting methodological data was taken from the book *Introductory Statistics for Business and Economics* (Wonnacott & Wonnacott, 1984), BPS technical guidelines on sampling error, and recent academic publications on statistical analysis (Elfrianto et al., 2025)

Analysis Technique The analysis was conducted by comparing the national TPT estimation parameters for 2025 and 2026. An assessment was made of the effectiveness of the Multi-Stage Sampling applied by BPS. To measure the reliability of proportion estimates (π), the 95% Confidence Interval formula was used as a valid approximation for large-scale surveys:

$$\pi = P \pm 1{,}96\sqrt{\frac{P(1-P)}{n}}$$

Variable description:

- π: Actual population proportion.

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- P: Proportion found in the sample.
- n: Sample size.
- 1.96: Critical value for 95% confidence level.
- $\sqrt{\frac{P(1-P)}{n}}$: *Sampling allowance* or margin of error.

The analysis also includes evaluation of variance components (between PSU and within PSU) and handling of *nonsampling error* through *weighting* and *data cleaning*. Weighting procedures include Initial Weight (inverse of sampling fraction), Adjusted Weight (adjustment for field realization), and Trimming to reduce weight variation between census blocks. Data cleaning involves handling missing data through imputation (median/mean) and outlier detection using IQR or Z-score methods before being processed using software such as SPSS, R, or Python.

RESULTS

General Overview of National Unemployment 2025-2026

The Indonesian labor situation shows a positive trend in economic recovery:

1. Year 2025: Labor force of 153.05 million people with a TPT of 4.76%.
2. Year 2026: Labor force increased to 154.91 million people, but TPT decreased to 4.68%.
3. Regional Disparity: Inequality still exists, where Papua Province recorded the highest TPT at 7.02%, while Bali was the lowest at 1.59%.
4. Demographic Characteristics**:** Urban unemployment (5.60%) is still higher than rural (3.20%). Based on education, Vocational High School (SMK) graduates contribute the highest unemployment rate at 7.74%, followed by High School (SMA) graduates at 6.23%.

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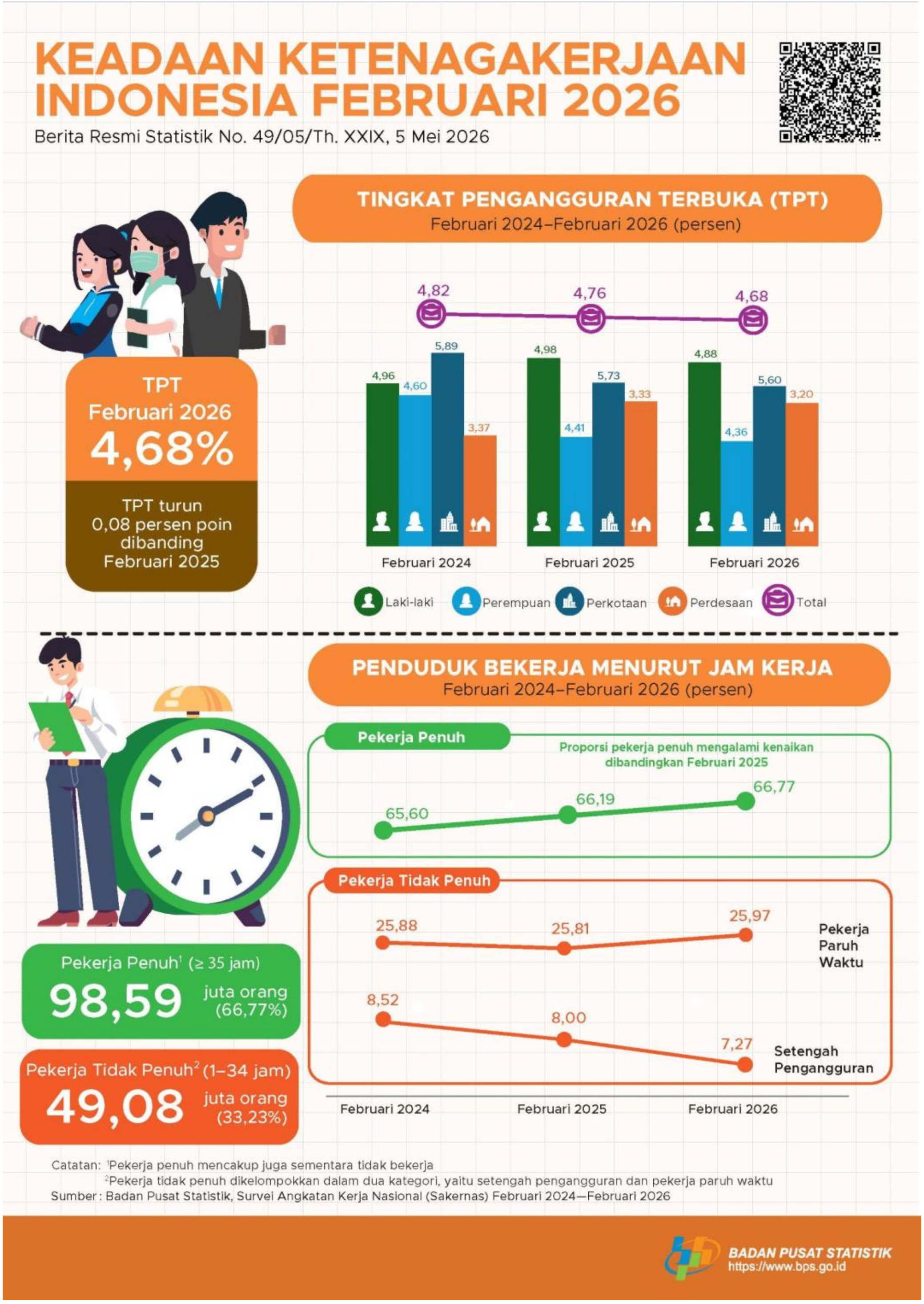

Figure 1. Employment Conditions in Indonesia
Source: Central Statistics Agency

Effectiveness of Sampling Methods: SRS vs Multi-Stage

A. Logistics and Cost Efficiency

BPS applies *Multi-Stage Sampling* to effectively cover wide areas. By dividing the population into clusters (districts/cities) and then sub-clusters (census blocks), data

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collection becomes geographically concentrated. This saves significant time and costs compared to SRS, which would require interviewers to visit respondents who might be in very isolated locations across the country. Pure SRS is considered operationally impractical due to the lack of a sampling frame covering individuals in detail down to the village level. The logistical burden of SRS in a archipelagic nation like Indonesia would be insurmountable given current resource constraints.

B. Accuracy and Confidence Interval

Source literature (*Introductory Statistics for Business and Economics*) mentions that large surveys such as those conducted by Gallup or the US Census Bureau use a combination of *multi-stage sampling* that provides accuracy almost equal to SRS. Therefore, the SRS formula can be used as a very good approximation. As an illustration of precision calculation: If a survey of the labor force finds an unemployment proportion (P) of 6% from a large sample ($n \approx 100{,}000$), then the margin of error is:

$$\text{Error} = 1{,}96\sqrt{\frac{0{,}06(1-0{,}06)}{100.000}} \approx 0{,}00147 \text{ atau } 0{,}15\%$$

The 95% confidence interval will provide a very small error range ($\pm 0.15\%$), giving assurance that the actual population value lies between 5.85% and 6.15%. Increasing the sample size drastically increases precision; if the sample is increased from 1,500 to 15,000 or 100,000, the confidence interval will shrink significantly. This demonstrates that even with a complex design, large sample sizes yield highly precise estimates.

C. Handling Nonsampling Error and Design Effect

Although *Multi-Stage Sampling* has a *sampling error* that tends to be slightly larger than SRS (because *Design Effect* > 1), its advantage in suppressing *nonsampling error* is much greater.

1. Field Supervision: Through concentrated supervision in selected census blocks, the quality of survey data can be guaranteed to be higher than a giant-scale census prone to administrative errors.
2. Weighting: In large surveys, weights are used to estimate population characteristics. The process includes *Initial Weight* (inverse of sampling fraction), *Adjusted Weight* (adjustment for field realization), and *Trimming* to reduce weight variation between census blocks.
3. Data Cleaning**:** Raw data goes through a cleaning cycle to handle *missing data* through imputation (median/mean) and outlier detection using IQR or Z-score methods before being processed using software such as SPSS, R, or Python. This rigorous post-collection processing ensures that the final estimates are robust against common field errors.

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DISCUSSION

This study reaffirms that while Simple Random Sampling (SRS) provides a strong conceptual foundation where every individual has an equal probability of selection, it is logistically prohibitive for national-scale estimates. The historical failure of the *Literary Digest* poll serves as a reminder that sample representativeness is more critical than sample size alone. However, in modern contexts like the 2026 Sakernas, the challenge is not just representativeness but operational feasibility. The findings indicate that Multi-Stage Sampling, as implemented by BPS, successfully balances statistical precision with cost efficiency.

The use of the SRS formula as an approximation for calculating confidence intervals in multi-stage designs is validated by the fact that large-scale surveys like the US CPS achieve similar accuracy levels. The key advantage lies in the reduction of *nonsampling errors*. By concentrating field officers in specific Primary Sampling Units (PSUs), supervision is tighter, leading to higher data quality. This is particularly important in developing countries where infrastructure challenges can lead to higher rates of non-response or data entry errors in dispersed samples.

The disparity in unemployment rates, particularly the high rate among SMK graduates (7.74%), highlights the importance of accurate data for policy formulation. If the sampling method were flawed (e.g., biased towards urban areas only), these critical insights into vocational education mismatches might be obscured. The application of *Design Effect* adjustments and proper weighting ensures that the final estimates of 4.68% TPT are robust and reflective of the true national condition. Furthermore, the technical handling of data through *trimming* of weights and imputation of missing values demonstrates the sophistication required in modern survey statistics. This goes beyond simple random selection and involves complex post-stratification to align sample demographics with known population totals.

The comparison also reveals that while SRS minimizes variance theoretically, the practical variance introduced by logistical failures in a pure SRS design would likely exceed the *Design Effect* penalty of multi-stage sampling. Thus, the "efficiency" of multi-stage sampling is not just financial but also statistical, as it reduces the total mean squared error by controlling nonsampling components. The use of rotating samples, as noted by Kish (1979), further enhances the efficiency of multi-stage designs by allowing for small area estimation and trend analysis over time, which is crucial for monitoring quarterly or monthly unemployment trends.

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CONCLUSION

Estimation of the national unemployment rate in Indonesia is most effectively carried out using the Multi-Stage Sampling method. This method provides a practical solution for large-scale data collection by balancing statistical precision and cost efficiency. Although Simple Random Sampling (SRS) is the ideal standard for unbiased estimators theoretically, the lack of a complete national sampling frame and high operational costs make it impractical. Multi-stage sampling allows for concentrated data collection, thereby suppressing nonsampling errors through stricter field supervision without significantly

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compromising data reliability. The use of 95% confidence intervals and Design Effect analysis is highly recommended to ensure that survey data has a level of certainty that can be accounted for by economic policymakers. Public policy should continue to rely on high-quality sampling data supported by strict field supervision to ensure data accuracy for economic decision-makers. Future research could explore the impact of digital data collection methods on reducing nonsampling errors further in multi-stage designs.

REFERENCES

Badan Pusat Statistik. (2026). Keadaan Ketenagakerjaan Indonesia Februari 2026. Jakarta: BPS.

Badan Pusat Statistik. (2008). Sampling Error Survei Sosial Ekonomi Nasional 2007. Jakarta: BPS.

Elfrianto, Nur'Afifah, Pulungan, L. H., & Irvan. (2025). Panduan Lengkap Analisis Statistik untuk Penelitian Skripsi, Tesis, dan Disertasi. Medan: UMSU Press.

Gramedia Literasi. (2021). Random Sampling: Pengertian, Jenis, Kelebihan dan Kekurangan. Retrieved Date 1 June 2026, http://www.taufanyanuar.com/2019/04/multi-stage-random-sampling.html

International Labour Organization. (2025). Survei Angkatan Kerja Nasional 2026 (Sakernas). Retrieved Date 1 June 2026, https://www.ilo.org/sites/default/files/2025-12/Jagasawitan%20AH.pdf

Kish, L. (1979). Rotating Samples for Small Area Estimation. New York: Wiley.

Silvia, S. (2015). Penerapan Metode Multistage Random Sampling pada Analisis Quick Count. Bandung: UPI Repository

Suprapto, A. (2000). Jenis Sampel: Keuntungan dan Kerugiannya. Neliti.

Taufanyanuar. (2019). *Multi Stage Random Sampling*. Retrieved Date 1 June 2026, http://www.taufanyanuar.com/2019/04/multi-stage-random-sampling.html

Wonnacott, T. H., & Wonnacott, R. J. (1984). Introductory Statistics for Business and Economics (3rd ed.). John Wiley & Sons.