JSDS: JOURNAL OF STATISTICS AND DATA SCIENCE
VOLUME 1, No 1, March 2022

https://ejournal.unib.ac.id/index.php/jsds/index

Simulation of Sample Determination Quick Count Legislative Elections In Bengkulu City

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Article Info

Article History:
Received: January 2, 2022
Revised: February 5, 2022
Accepted: February 12, 2022
Available Online: March 1, 2022

Key Words:
Quick Count,
Sampling Method
Sample Simulation
Chi-Squared Test.

Abstract

In this research illustrates the simulation of quick count of sampling for the year 2014 Legislative Election in Bengkulu City, which has a data acquisition result for 589 TPS. The problem in this research is how to know the sample size and the right sampling method for Legislative Election in Bengkulu City on Year 2014. The purpose of this research is to know the sample size and the quick count calculation sampling method that can predict the actual vote result for Legislative Election. The method used in the calculation of fast calculation consists of three methods, simple random sampling, cluster random sampling and multistage random sampling. From the population data of 589 polling stations (TPS) into the population, the sample size was taken as much as 120 TPS or about 20% of the population, based on the results of calculations for sample sizes in a limited population. After the sample was selected, a sample simulation of 100 times for each method and simulation results was tested for compatibility with the chi-squared test. Based on the test results, it can be concluded that for sample size 120 TPS taken by simple random sampling method, cluster random sampling or multistage random sampling can predict the actual vote result in Legislative Election Year 2014 in Bengkulu with margin of error 5%. For efficiency consideration simple random sampling method can be selected.

1. INTRODUCTION

The simulation of determining the quick count sample in Bengkulu City aims to choose the right size and method of taking quick count samples in the 2014 Legislative Election. The quick count is a method for predicting election results, which is carried out by calculating the percentage of voting results at polling stations based on sample data. The quick count is commonly carried out by institutions or individuals interested in an election or election outcome. One of the uses of quick count results is as a comparison of real counts.

The success of the quick count is highly dependent on the sampling technique. Several sampling techniques are simple random sampling, stratified random sampling, cluster random sampling. The selection of methods is adjusted to the characteristics of the region and the community. Determining the number of samples is also very important in quick counts. Sampling with the right amount is very influential on costs and quick count results.

12 Political Parties attended the Legislative Election in Bengkulu City in 2014. The legislative election will elect members of the House of Representatives of the Republic of Indonesia (DPR RI), members of the Regional Representative Council of the Republic of Indonesia (DPD RI), members of the Provincial DPRD (Provincial DPRD) and Regency Level Regional People's Representative Council (Regency DPRD). The final results of the general election can only be known after the voting and vote counting processes are carried out, the results of which are said to be complete and valid and take a long time to complete. The quick count method helps know the election results only a few moments after voting and counting at the polling station.

In this study, the simulation results of quick count calculations in Bengkulu City will be compared with three sampling methods, namely simple random sampling, cluster random sampling and multistage random sampling.

2. METHOD

The data in this study are data from the C1 form (vote results) of Bengkulu City in the 2014 Legislative Election. The data was obtained from the General Election Supervisory Agency of Bengkulu Province in September 2017. There are 589 polling stations spread over nine sub-districts in Bengkulu City.

The analysis used is to obtain simulation data based on simple random sampling methods, cluster random sampling and multistage random sampling. The analysis steps are as follows:

1. Provide serial numbers and codes for all TPS in the population to be sampled;
2. Determine the mean value of the population;
3. Determine the TPS to be sampled by taking a TPS sample by:
   a. Simple Random Sampling (SRS) (Margono, 2014)
      1) Generate 589 random numbers;
      2) Sorting random numbers from smallest to largest.
      3) Take the first 120 random numbers, then continue to adjust the first 120 random numbers with the serial number and code from the TPS in the population to be sampled
      4) Calculating the total gains from 120 sample polling stations selected for the votes of DPR, DPRD I, DPRD II and DPD, followed by calculating the percentage;
      5) Conducting the goodness of fit test with the chi-square test.
   b. Cluster Random Sampling (CRS) (Cochran, 1977)
      1) Sort and code all TPS in the village based on the sub-district in Bengkulu City;
      2) Generate random numbers as many as the total TPS and each random number according to the TPS code;
      3) Take a proportional sample TPS from the selected village for all sub-districts by taking a random sample TPS up to a total of 120 TPS samples;
      4) Calculate the total gains from 120 sample polling stations selected for the votes of DPR, DPRD I, DPRD II and DPD, followed by calculating the percentage;
      5) Perform the goodness of fit test with the chi squares test.
   c. Multistage Random Sampling (MRS) (Kismiantini, 2007)
      1) Take randomly five subdistricts from all subdistricts (nine subdistricts);
      2) Take randomly four villages from each five subdistricts to be used as sample villages;
      3) Take randomly six TPS from each village in the five selected village as samples so there are 120 sample TPS;
      4) Count the total gains from the 120 sample polling stations selected for the votes acquired by the DPR, DPRD I, DPRD II and DPD, followed by calculating the percentages;
      5) Perform the goodness of fit test with the chi squares test.
4. Simulating 100 times and calculating the simulation results from each method as step 2 letters a, b and c using Microsoft Excel;
5. Calculate the Margin of Error (MoE) by (Scheaffer, Mendenhall, and Gerow, 2011)

$$MoE = \frac{s}{\sqrt{n}} z$$

with:

s = standard deviation (usually 0.5)

z = z value for a certain level of confidence

n = sample size

The Ho and Ha hypotheses that will be used in this study are:

Ho: There is no difference between the calculation results in percentage terms between the Quick Count and the actual results of the Legislative Elections 2014 in Bengkulu City

Ha: There is a difference in the calculation results in percentage terms between the Quick Count and the actual calculation results for the Legislative Elections 2014 in Bengkulu City

The statistic for the hypotesis test is (Agresti, 2003)

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$$

where :
O : Average of real count calculation results (observation value)
E : Average of quick count calculation result (expected value)
db (degrees of freedom) : $(b-1)(k-1)$
b : number of rows
k : number of columns

3. RESULTS AND DISCUSSION

First of all, all population TPS are assigned a TPS number and code based on the sub-district, village and TPS number. The coding of TPS numbers and codes uses five-digit numbers. The first digit represents the sub-district, the second and third numbers represent the village and the fourth and fifth digits represent the TPS number.

Table 1 show the codes and numbers for all TPS based on subdistricts and village in Bengkulu City from the data used in this paper.

Table 1. Numbering and Coding of TPS by Subdistrict and Village

Subdistrict	Code	Village	Code	TPS Number
Gading Cempaka	1	Cempaka Permai	01	01 s.d. 16
		Jalan Gedang	02	01 s.d. 13
		Lingkar Barat	03	01 s.d. 17
		Padang Harapan	04	01 s.d. 10
		Sido Mulyo	05	01 s.d. 27
Kampung Melayu	2	Kandang	01	01 s.d. 10
		Muara Dua	02	01 s.d. 03
		Padang Serai	03	01 s.d. 07
		Sumber Jaya	04	01 s.d. 16
		Teluk Sepang	05	01 s.d. 07
Muara Bangkahulu	3	Bentiring	01	01 s.d. 09
		Kandang Limun	02	01 s.d. 12
		Pematang Gubernur	03	01 s.d. 14
		Rawa Makmur Permai	04	01 s.d. 12
		Rawa Makmur	05	01 s.d. 12
Ratu Agung	4	Kebun Beler	01	01 s.d. 09
		Kebun Kenanga	02	01 s.d. 12
		Kebun Tebeng	03	01 s.d. 10
		Lempuing	04	01 s.d. 08
		Nusa Indah	05	01 s.d. 12
		Sawah Lebar	06	01 s.d. 18
		Sawah Lebar Baru	07	01 s.d. 17
		Tanah Patah	08	01 s.d. 14

Subdistrict	Code	Village	Code	TPS Number
Teluk Segara	5	Jitra	01	01 s.d. 03
		Kebun Keling	02	01 s.d. 03
		Kebun Ross	03	01 s.d. 03
		Kampung Bali	04	01 s.d. 05
		Malabero	05	01 s.d. 06
		Pasar Baru	06	01 s.d. 03
		Pasar Melintang	07	01 s.d. 05
		Pondok Besi	08	01 s.d. 04
		Pintu Batu	09	01 s.d. 03
		Sumur Meleleh	10	01 s.d. 02
		Tengah Padang	11	01 s.d. 10
Sungai Serut	6	Kampung Kelawi	01	01 s.d. 06
		Pasar Bengkulu	02	01 s.d. 04
		Semarang	03	01 s.d. 04
		Sukamerindu	04	01 s.d. 16
		Surabaya	05	01 s.d. 13
		Tanjung Agung	06	01 s.d. 02
		Tanjung Jaya	07	01 s.d. 03
Singaran Pati	7	Dusun Besar	01	01 s.d. 04
		Jembatan Kecil	02	01 s.d. 11
		Lingkar Timur	03	01 s.d. 12
		Padang Nangka	04	01 s.d. 15
		Panorama	05	01 s.d. 28
		Timur Indah	06	01 s.d. 07
Selebar	8	Betungan	01	01 s.d. 14
		Bumi Ayu	02	01 s.d. 12
		Pagar Dewa	03	01 s.d. 41
		Pekan Sabtu	04	01 s.d. 10
		Sukarami	05	01 s.d. 16
		Sumur Dewa	06	01 s.d. 11
Ratu Samban	9	Kebun Dahri	01	01 s.d. 04
		Padang Jati	02	01 s.d. 08
		Penggantungan	03	01 s.d. 06
		Penurunan	04	01 s.d. 11

After numbering and coding, it is continued by calculating the average percentage of votes acquired by each political party for the DPR, DPRD I and DPRD II, and members of the DPD. The percentage results are presented in Table 2.

The next step is to take a sample size of TPS using formula (Levy and Lemeshow, 2008)

$$n \geq \frac{z_{(1-\alpha)}^2 \sigma^2}{\varepsilon^2}$$

where n is sample size, $z_{1-\alpha}$ is standard normal value for confidence level $1-\alpha$, σ is variance of population, ε is error. Taking the value of $z_{0,95} = 1.645$, $\sigma^2 = 0.18$, $\varepsilon = 0.05$ result in $n \approx 120$.

Quick count sampling for the simulation was carried out using three methods: simple random sampling, cluster random sampling and multistage random sampling. Based on the calculations for each method, the probability value for the three methods is 1 or very close to 1, so it can be concluded that the samples taken with the three methods can represent the population. The advantages and disadvantages of the three methods as shown in Table 3.

Table 2. Percentage of votes based on population data

Number of Party or DPD Candidate	DPR	DPRD I	DPRD II	DPD
1	16,46	11,72	13,05	3,21
2	6,76	6,14	7,56	38,27
3	11,34	8,83	7,11	2,50
4	12,05	8,55	5,65	5,51
5	7,08	9,62	10,25	1,49
6	10,54	15,42	12,56	5,19
7	9,32	11,76	8,09	2,15
8	10,29	8,12	12,37	8,68
9	6,74	8,53	7,71	1,12
10	5,40	3,92	5,79	1,38
11	-	-	-	7,75
12	-	-	-	1,67
13	-	-	-	4,42
14	2,39	5,43	4,68	0,90
15	1,63	1,96	5,20	1,21
16	-	-	-	5,61
17	-	-	-	2,65
18	-	-	-	3,13
19	-	-	-	0,33
20	-	-	-	2,83

Tabel 3. The advantages and disadvantages of the three sampling methods

Methods	Advantages	Disadvantages
Simple Random Sampling (SRS)	Sampling is faster because the sample is taken from the entire population.	The probability that the entire region is represented in the sample is small. There is high potential that the distance between sample member is long.
Cluster Random Sampling (CRS)	The sample consists of all subdistricts.	Sampling is more complicated because it is taken at the subdistrict level. The sample is spread throughout the region so that the research is carried out throughout the region.
Multistage Random Sampling (MRS)	The sampling area is narrower because the sampling area is classified from the selected subdistricts and villages.	Sampling is complicated because it must be carried out through a bit longer stages, from the subdistrict level to the TPS level.

Table 4. The results of the goodness of fit test for the subdistrict

Subdistrict	DPR	DPRD I	DPRD II	DPD
Gading Cempaka	3,224*	4,140*	6,874	2,852*
Kampung Melayu	8,811	7,341	34,156	7,500*
Muara Bangkahulu	1,780*	6,151	11,656	6,046*
Ratu Agung	1,993*	4,143*	7,497	2,931*
Teluk Segara	7,248	10,904	16,560	3,814*
Sungai Serut	1,634*	5,889	12,701	1,901*
Singaran Pati	1,303*	4,083*	8,164	4,279*
Selebar	3,206*	6,770	9,639	3,130*
Ratu Samban	11,620	6,873	13,713	8,787*

***)** reliable to predict

The purpose of the compatibility test is to find reliable areas to be used as quick count samples for the 2014 Legislative Election in Bengkulu City, which can be used as input in comparing models to be used in the quick count process. The results of the test for the subdistrict and village level are shown in Table 4 dan Table 5.

Table 5. The results of the goodness of fit test for the village

Village	DPR	DPRD I	DPRD II	DPD
Cempaka Permai	7,615	28,238	20,151	4,734*
Jalan Gedang	3,040*	8,627	11,974	6,018*
Lingkar Barat	4,264*	2,744	11,985	22,366
Padang Harapan	8,797	9,509	14,971	3,625*
Sido Mulyo	3,520*	2,481*	14,044	2,692*
Kandang	11,989	13,428	47,220	8,300*
Muara Dua	13,081	22,366	145,697	7,353*
Padang Serai	20,632	19,954	43,598	17,445
Sumber Jaya	20,743	16,994	35,301	13,156
Teluk Sepang	7,306	10,249	109,536	33,456
Bentiring	4,986*	10,265	46,792	10,402*
Kandang Limun	20,139	16,623	41,975	7,396*
Pematang Gubernur	4,393*	24,376	18,785	10,796*
Rawa Makmur Permai	3,499*	4,871*	21,707	8,605*
Rawa Makmur	6,587	7,711	13,550	31,531
Kebun Beler	2,636*	4,930*	18,580	8,719*
Kebun Kenanga	3,466*	8,650	16,300	6,951*
Kebun Tebeng	2,671*	35,580	17,273	6,707*
Lempuing	10,285	41,747	33,770	9,781*
Nusa Indah	5,463*	3,719*	8,683	10,271*
Sawah Lebar	5,928	36,361	17,884	16,741
Sawah Lebar Baru	5,837	18,754	32,482	9,410*
Tanah Patah	10,207	6,106	10,159	22,345
Jitra	45,066	29,622	115,491	33,825
Kebun Keling	46,187	61,095	87,269	13,139
Kebun Ros	14,433	17,247	30,618	18,951
Kampung Bali	6,509	46,028	39,485	22,880
Malabero	41,890	30,885	32,785	18,101
Pasar Baru	9,796	31,972	38,838	8,616*
Pasar Melintang	14,958	49,069	70,788	11,391*
Pondok Besi	14,787	20,756	29,349	17,007
Pintu Batu	12,223	34,966	45,098	6,427*
Sumur Meleleh	7,035	33,009	25,148	18,557
Tengah Padang	8,935	8,949	13,361	11,132*
Kampung Kelawi	6,975	37,255	58,413	4,277*
Pasar Bengkulu	18,888	244,789	39,092	33,670
Semarang	13,292	19,921	61,594	6,013*
Suka Merindu	2,957*	20,060	25,181	9,607*
Surabaya	3,425*	5,661	26,870	3,666*
Tanjung Agung	21,582	38,209	63,682	13,415
Tanjung Jaya	9,045	28,380	33,259	13,168
Dusun Besar	11,845	24,582	139,592	30,485
Jembatan Kecil	4,229*	15,175	7,284	18,513
Lingkar Timur	8,032	10,953	11,772	9,143*

Village	DPR	DPRD I	DPRD II	DPD
Padang Nangka	3,560*	7,247	44,829	5,121*
Panorama	3,438*	14,206	10,080	10,407*
Timur Indah	1,332*	6,827	4,801*	3,391*
Betungan	3,730*	11,325	15,232	4,235*
Bumi Ayu	8,198	21,590	35,754	21,005
Pagar Dewa	5,187*	17,665	22,394	2,071*
Pekan Sabtu	3,787*	11,869	17,702	18,234
Sukarami	4,420*	3,170*	12,823	3,205*
Sumur Dewa	5,320*	14,729	18,234	10,797*
Kebun Dahri	35,004	36,255	65,204	36,436
Padang Jati	5,966	18,962	7,619	13,090
Pengantungan	39,649	15,351	81,402	32,022
Penurunan	20,746	9,307	36,708	10,353*

***)** reliable to predict

The results of the goodness of fit test for the subdistricts and villages that suitable to the data can be described as follows:

1) For the prediction of the results of the DPR vote based on subdistrict level, Kampung Melayu, Teluk Segara and Ratu Samban are not reliable to predict. As for the village level, Jalan Gedang, Lingkar Barat, Sidomulyo, Bentiring, Pematang Gubernur, Rawa Makmur Permai, Kebun Beler, Kebun Kenanga, Kebun Tebeng, Nusa Indah, Sukamerindu, Surabaya, Jembatan Kecil, Padang Nangka, Panorama, Timur Indah, Betungan, Pagar Dewa, Pekan Sabtu, Sukarami and Sumur Dewa are reliable to predict.
2) For the prediction of the results of the DPRD I vote based on subdistrict level, only Gading Cempaka, Ratu Agung and Singaran Pati are reliable to predict. Then on the basis of village level, the reliable predictor are Lingkar Barat, Sidomulyo, Rawa Makmur Permai, Kebun Beler, Nusa Indah and Sukarami.
3) For the prediction of the results of the DPRD II vote at the subdistrict level, no one subdistrict is reliable for predicting. As for the village level, only Timur Indah is reliable for predicting.
4) For the prediction of the results of the DPD vote at subdistrict level, all subdistricts are reliable for predicting. While at the village level, Lingkar Barat, Padang Serai, Sumber Jaya, Teluk Sepang, Rawa Makmur, Sawah Lebar, Tanah Patah, Jitra, Kebun Keling, Kebun Ross, Kampung Bali, Malabero, Pondok Besi, Sumur Meleleh, Pasar Bengkulu, Tanjung Agung, Tanjung Jaya, Dusun Besar, Jembatan Kecil, Bumi Ayu, Pekan Sabtu, Kebun Dahri, Padang Jati and Pengantungan is not reliable predict.

The Margin of Error (MoE) describes the number of errors that usually occur in sampling in surveys conducted by researchers. Margin of Error in this study by taking standard deviation $s = 0.5$; $n = 120$ and $z = 1.645$ ($\alpha = 5\%$) is

$$MoE = \frac{s}{\sqrt{n}} z = \frac{0,5}{\sqrt{120}} 1,645 = 0,075$$

In other words, the error is leading to the conclusion that there is no difference between the results of the sample based calculation and the actual result of the general election for Bengkulu City.

4. CONCLUSION

Based on the results and discussions that have been carried out to answer the main problems in this paper, related to the size and method of taking quick count samples, with reference to the 2014 Legislative Election results in Bengkulu City, we can conclude that the 589 TPS population which are spread over the city of Bengkulu, 120 TPS samples can be taken using the simple random sampling method, cluster random sampling or multistage random

sampling to become a quick count sample. One of the reasons for sampling as many as 120 TPS is because it is about 20% of the total population. The three sampling methods can produce a quick count sample that can predict the actual vote count results in the 2014 Legislative Election in Bengkulu City.

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