

15th National Convention on Statistics

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ABSTRACT

The Philippine Statistics Authority is one of the three members of the technical working group formed by the Commission on Election (COMELEC) primarily assigned to do the random manual audit on the results of the 2022 national and local elections. The random manual audit as mandated by law under Section 24 of Republic Act No. 9369 is the process of determining the accuracy of the results of Automated Election System (AES) for the National and Local elections in the country held last May 9, 2022.

The PSA as member of Random Manual Audit Committee (RMA) was involved particularly in the following activities: (1) Preparation of sampling design for the sample allocation and sample selection of 757 clustered precincts; (2) Development of the Automated Random Selection Program (ARSP); (3) Development of Data capture (with full verification feature) and RMA processing and tabulation systems to facilitate the computation of “variance” and “accuracy rate” for the identified national and local positions (President, Vice-President, Senator, Party List, Member, House of Representatives, and Mayor)

This paper aims to introduce the process used by the PSA-RMA team in the implementation of the 2022 random manual audit for the 2022 National and Local Elections in the Philippines.

1. Introduction

The Philippine Statistics Authority (PSA) is one of the three members of the technical working group formed by the Commission on Election (COMELEC) primarily assigned to do the random manual audit on the results of the 2022 national and local elections. The random manual audit as mandated by law under Section 24 of Republic Act No. 9369 is the process of determining the accuracy of the results of Automated Election System (AES) for the National and Local elections in the country held last May 9, 2022. In the manual audit process, the number of votes counted by Vote-Counting Machine (VCM) or the Automated Election System (AES) is compared against the number of votes manually counted by the Random Manual Audit Team (RMAT). The process is done for every sample clustered precinct for the positions of Senator, Member of House of Representatives, and Mayor. The resulting count difference between the AES count and RMA count, which is also referred to as the “variance”, was calculated for each candidate from a total of 757 sample clustered precincts distributed proportionately according to the measure of size or number of clustered precincts in a legislative district in the Philippines.

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2. The Role of the PSA

The PSA as member of Random Manual Audit Committee (RMAC) was involved particularly in the following activities: (1) Preparation of sampling design for the sample allocation and sample selection of 757 clustered precincts; (2) Development of the Automated Random Selection Program (ARSP); (3) Development of Data capture (with full verification feature) and RMA processing and tabulation systems to facilitate the computation of “variance” for identified national and local positions (President, Vice-President, Senator, Party List, Member, House of Representatives, and Mayor; (4) Preparation of summary tables on variances; (5) Determination of allowable margin of “variance”; and (6) Preparation of summary report.

This paper includes only the activities done by the PSA team and does not represent the complete results of the random manual audit as other activities specifically done by the other teams of the Random Manual Audit Committee (RMAC) are not included in this report.

3. The Automated Random Selection Program (ARSP)

The actual random selection of sample clustered precincts was held on May 10, 2022, at the COMELEC Command Center at the Philippine International Convention Center (PICC). Using an automated random selection program (ARSP) developed by the Philippine Statistics Authority (PSA) the 757 sample clustered precincts were successfully drawn. The list of sample clustered precincts is shown in Annex A.

The Automated Random Selection Program (ARSP) is a computer application system that contains routines, functions, and algorithms developed in java and MySQL database system. The same program was subjected to source code review by Registered Political Parties and Accredited Citizens' Arm Groups. The ARSP is developed to speed-up and automate the sample selection process. Figure 1 shows the screenshot of the program that was used to facilitate the random selection process.



The RMA-PSA Team running the Automated Random Selection Program to draw samples at the COMELEC Command Center in the Philippine International Convention Center on 10 May 2022

Figure 1. Screenshot of Automated Random Selection Program (ARSP)

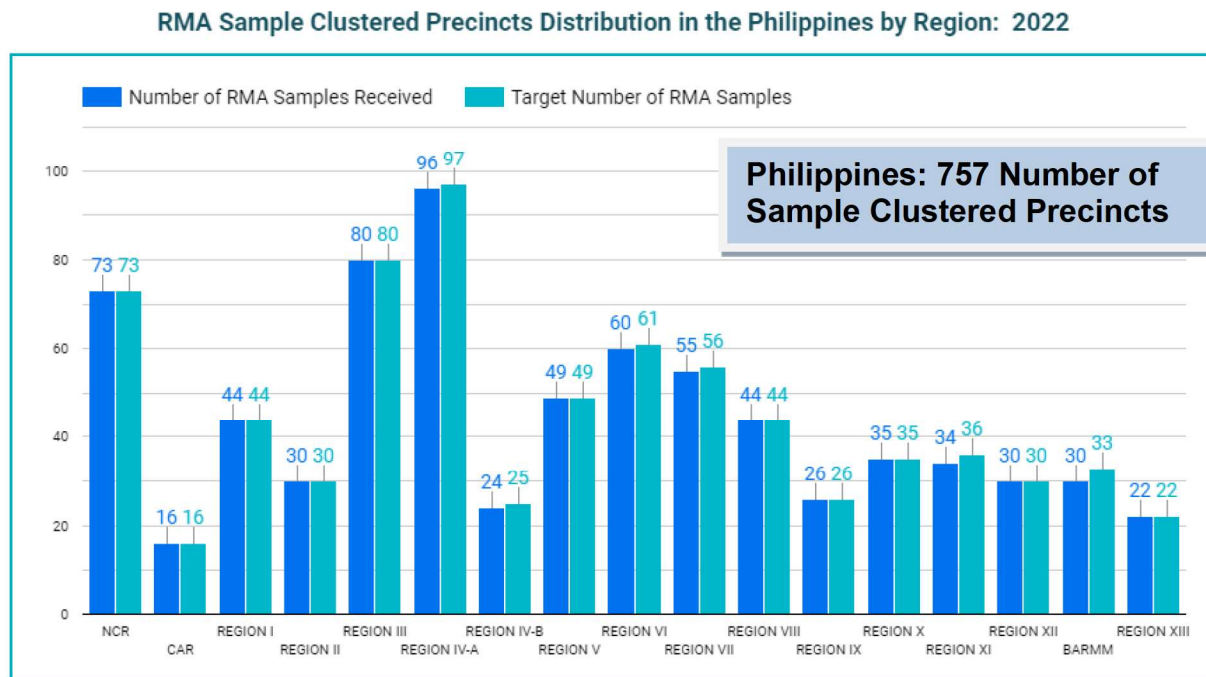


3.1. Sample Selection Procedure

In a probability sampling, every element in the population has a known chance of being selected. At the initial stage, Probability Proportionate to Size (PPS) is applied to select the first stage elements with the number of clustered precincts as the measure of size. The term “element” here refers to the “cities/municipalities” within a legislative district. Likewise, during the second and final stage of randomized selection process, the term “element” also refers to the “clustered precincts” within the selected sample city/municipality. During the second stage selection, for each sample city/municipality, the allocated sample clustered precincts are drawn using Simple Random Sampling (SRS) without. The random selection procedure is designed to draw two sets of samples (i.e., (1) *the priority list of samples* and (2) *the contingency list of samples*).

The priority set of sample contains the list of randomly selected priority cities/municipalities and the corresponding priority list of 757 randomly selected clustered precincts. On the other hand, the contingency list of sample contains the list of randomly selected contingency cities/municipalities and the corresponding randomly selected contingency clustered precincts. The contingency list of samples is used as replacement in case of a failure of random manual audit (RMA) in any of the priority sample due to accessibility and peace and order problems. The number of sample clustered precincts for each region is also shown in Figure 2.

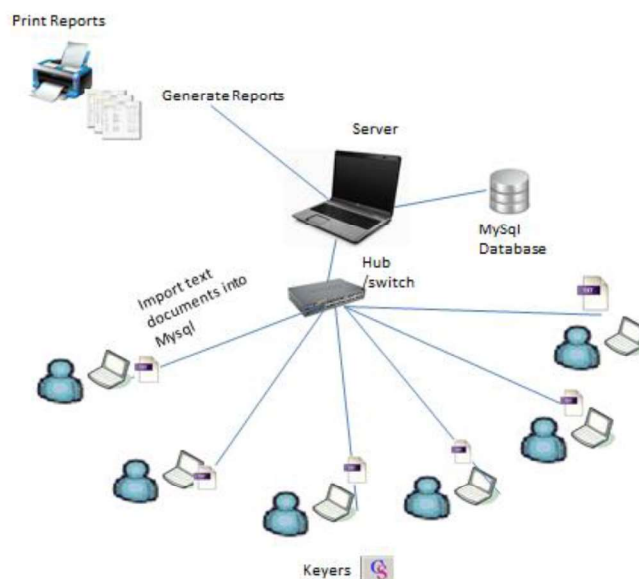
Figure 2. RMA Sample Clustered Precincts Distribution in the Philippines by Region: 2022



4. PSA-RMA Processing Network Configuration Setup

The 2022 PSA-RMA processing system was configured using a network environment with MySQL database server and 12 workstations. The RMA processing system consists of 3 (three) modules (i.e., (1) *Receipt, Control and Monitoring Module*, (2) *Data Capture Module*, and (3) *SQL Run Module*). The data capture module of the system utilized web-based application using java language. The formulated SQL script stored as file is generated using the SQL run module Figure 3 illustrates the Network Configuration setup of the RMA processing system.

Figure 3. 2019 PSA-RMA Network Configuration



PSA-RMA Processing Flow

Validated RMA reports are transmitted by the RMA validation group of the RMAC to the PSA-RMA team for processing, tabulation and analysis. An internal and unique identification control number is assigned to each RMA report received. The assigned PSA encoders input the data in their corresponding workstation. The encoded data are then uploaded to MySQL Database. These data went through internal validation to check for possible encoding errors and to tag if those processed RMA reports has more than 10 votes' difference or "variance" between marked votes counted by the Vote-Counting Machine (VCM) for further validation. The system is capable generating completeness report and tabulations to generate preliminary reports anytime or in real time. Figure 4 shows the detailed process flow of the PSA-RMA processing system.

Figure 4. 2019 PSA-RMA Processing Flow

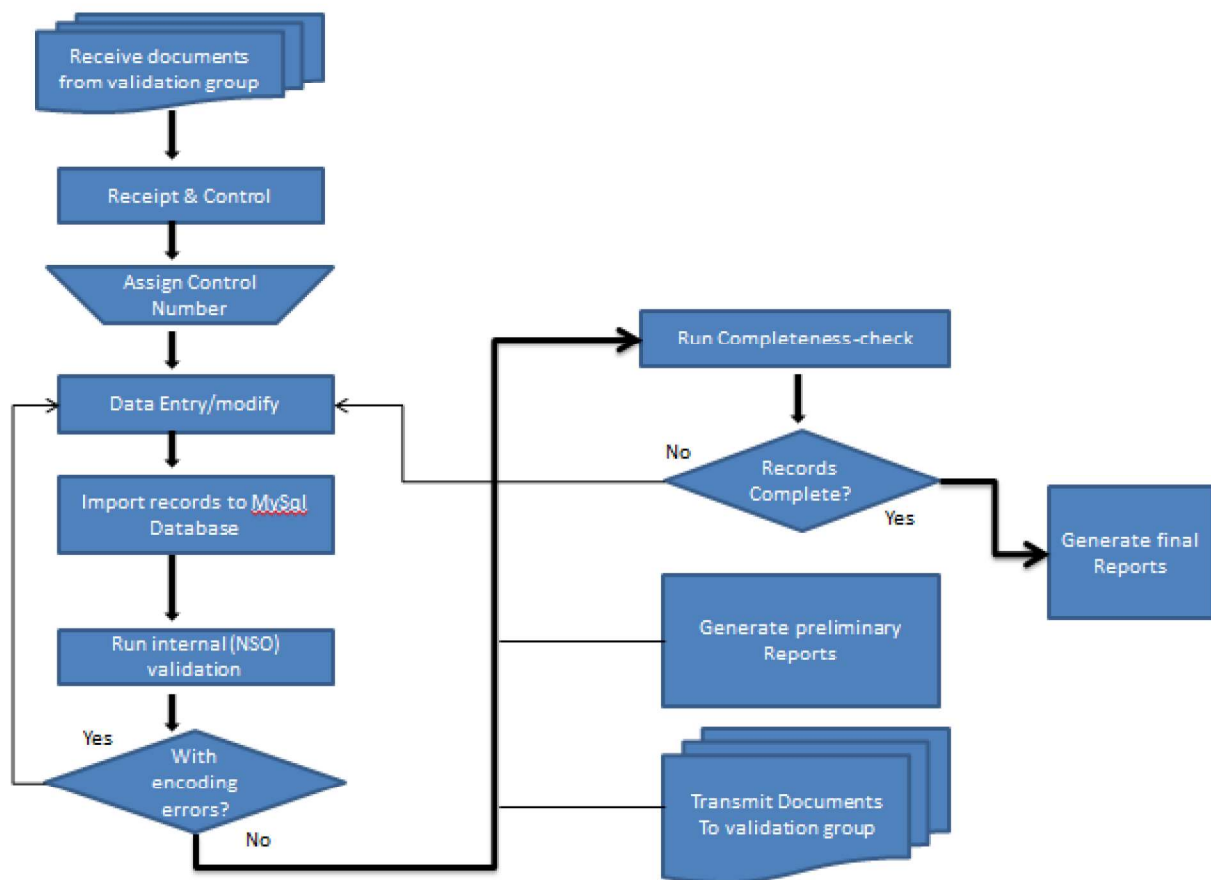


Figure 5. Receipt and Control Module System Interface

Receipt and Control

Search:

Samples	Keyer	Date Assigned	Date Returned
Sample ID: 1 Municipality: LANTAWAN Barangay: MATIKANG Clustered Precinct No. : 0050A, 0050B, 0051A, 0051B, 0051P1 Region: BARMM Province: BASILAN Legislative District: BASILAN - LONE LEGDIST Precinct ID: 7030033			
Sample ID: 2 Municipality: LANTAWAN Barangay: TAIRAN Clustered Precinct No. : 0039A, 0040A, 0040P1, 0040P2 Region: BARMM Province: BASILAN Legislative District: BASILAN - LONE LEGDIST Precinct ID: 7030027			
Sample ID: 3 Municipality: LANTAWAN Barangay: LUUK-MALUHA Clustered Precinct No. : 0041A, 0041B, 0041C, 0041D, 0041E			

Figure 6. Data Capture Module System Interface

Login -- Version(2.0)

User Name:

Assigned Sample:

Page 1 Totals - Sample ID(46) - Keyer(benjie)

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Condition of Ballot Box	
Number of Self-Locking Fixed Length Seal	
Serial Number of Self-Locking Fixed Length Seal	
Number of VVPATs	
Number of Valid Ballots	
Number of Voters who Actually Voted	
Number of Registered Voters	

A. NATIONAL POSITIONS	Per RMA					
	OVERVOTES	UNDERVOTES	MISPLACED SHADES		INCOMPLETE SHADES	
			YES	NO	COUNTED	NOT COUNTED
PRESIDENT						
VICE-PRESIDENT						
SENATOR						

MINUTES / REMARKS

<< Mayor
Page 2 Totals >>

Figure 7. SQL Run Module System Interface

Search:

Samples	Keyer	Date Assigned	Date Returned
Sample ID: 1 Municipality: LANTAWAN Barangay: MATIKANG Clustered Precinct No.: 0050A, 0050B, 0050C Region: BARMM Province: BASILAN Legislative District: BASILAN - LONE LEGDIST Precinct ID: 7030033		05 16:44:35.0	2022-06-05 18:21:14.0
Sample ID: 2 Municipality: LANTAWAN Barangay: TAIRAN Clustered Precinct No.: 0039A, 0040A, 0040P1, 0040P2 Region: BARMM Province: BASILAN Legislative District: BASILAN - LONE LEGDIST Precinct ID: 7030027		06-01 20:28:28.0	2022-06-01 22:08:43.0
Sample ID: 3 Municipality: LANTAWAN Barangay: LUUK-MALUHA			

Reports
View Encoded
Update Encoded

6. Number of Sample Clustered Precincts with Complete RMA Reports

As of June 24, 2022, a total of 748 completed RMA reports or 98.8 percent of the 757 total sample clustered precincts were received and processed by the Philippine Statistics Authority (PSA) for analysis and processing to generate “variance” summary report. An RMA minutes/report for a given sample clustered precincts is considered complete if the number of votes per Election Return (ER) and per Random Manual Audit (RMA) are available and further validations can be made to review the initial audit results submitted by the Random Manual Audit Team (RMAT) to the COMELEC. The distribution of 748 sample clustered precincts with complete and validated RMA reports by region is shown in Table 1.

Table 1. Distribution of Sample Clustered Precincts with Complete and Validated RMA Reports by Region: Philippines 2022

Area	Number of Clustered Precincts			Completion Rate (in percent)
	Population (N)	Sample (n)	Completed and Validated RMA Reports (n')	
Philippines	106,174	757	748	98.81
NCR	10,538	73	73	100.00
CAR	2,153	16	16	100.00
REGION I	6,127	44	44	100.00
REGION II	4,054	30	30	100.00
REGION III	10,993	80	80	100.00
REGION IV-A	13,965	97	96	98.97
MIMAROPA	3,348	25	24	96.00
REGION V	6,656	49	49	100.00
REGION VI	8,570	61	60	98.36
REGION VII	8,129	56	55	98.21
REGION VIII	6,271	44	44	100.00
REGION IX	3,831	26	26	100.00
REGION X	4,986	35	35	100.00
REGION XI	4,834	36	34	94.44
REGION XII	4,074	30	30	100.00
BARMM	4,566	33	30	90.91
Caraga	3,079	22	22	100.00

Source: 2022 Random Manual Audit Results

7. Variance Summary Results

The term “variance” here refers to the absolute difference between the number of votes as per ER and RMA. The “variance” was computed at the sample clustered precinct level. The sum of “variance” at the regional level was computed by adding all the “variance” computed at the clustered precincts within the region. The national total “variance” is the sum of the “variance” of all the regions. *Table 3a* shows the variance summary results.

Table 2. Variance Summary Results: Philippines, 2022

Area	Total Variance (In Absolute Value)					
	President	Vice-President	Senator	Party List	Member, House of Representatives	Mayor
Philippines	107	110	908	374	96	127
NCR	3	5	44	30	2	4
CAR	0	0	3	9	0	2
REGION I	6	5	64	10	4	6
REGION II	5	3	39	14	7	0
REGION III	17	31	173	81	23	39
REGION IV-A	11	13	96	32	13	34
MIMAROPA	3	5	15	11	2	1
REGION V	6	5	31	20	5	4
REGION VI	8	6	65	38	11	10
REGION VII	5	4	102	20	5	1
REGION VIII	5	5	94	36	10	8
REGION IX	3	3	52	20	4	3
REGION X	7	5	51	11	1	2
REGION XI	9	8	13	16	4	6
REGION XII	11	6	38	9	2	3
BARMM	4	4	15	10	2	3
Caraga	4	2	13	7	1	1

Source: 2022 Random Manual Audit Results

7.1 Distribution of Clustered Precinct According to the aggregated “Variance”

A “variance” is considered large if the cumulative variance for all candidates in all six positions (i.e., President, Vice-President, Senator, Party List, Member of House of Representatives, and Mayor) is more than 10. The validation includes the determination of the possible source of discrepancies. Variances found due to clerical/mathematical errors were immediately corrected and reflected in the variance summary results. However, errors other than clerical/mathematical are referred to the Technical Evaluation Committee for root cause analysis. Of the 748 completed sample clustered precincts, 522 or 69.8 percent have zero “variance” while there are 10 clustered precincts with 10 or more “variance”.

Table 3. Distribution of Clustered Precincts According to “Variance” by Region

Area	Number of Sample Clustered Precincts According to "Variance" After Validation				Total
	With zero "variance"	With 1 to 4 "variance"	With 5 to 9 "variance"	With 10 or more "variance"	
Philippines	522	180	36	10	748
NCR	53	14	3	3	73
CAR	10	5	1	0	16
REGION I	26	11	5	2	44
REGION II	15	10	3	2	30
REGION III	37	25	13	5	80
REGION IV-A	60	26	5	5	96
MIMAROPA	16	4	3	1	24
REGION V	32	11	4	2	49
REGION VI	35	17	4	4	60
REGION VII	38	9	4	4	55
REGION VIII	23	17	1	3	44
REGION IX	18	3	4	1	26
REGION X	16	15	3	1	35
REGION XI	21	7	5	1	34
REGION XII	16	11	1	2	30
BARMM	22	5	1	2	30
Caraga	14	6	1	1	22

Source: 2022 Random Manual Audit Results

8. Accuracy Rate

The accuracy rate for each RMA position is computed as the ratio between the cumulative “variance” and the total votes per AES. This can also be determined as the complement of percentage variance. At the national level the overall accuracy rate for all positions was estimated at 99.95 percent. (Table 5a).

Table4. Summary Report on Variance and Accuracy Rate, 2022

RMA Position	Total		Variance (Difference between AES and RMA) in absolute value	Accuracy Rate
	Per AES	Per RMA		
President	368,991	369,052	107	99.9710
Vice-President	359,080	359,128	110	99.9694
Senator	2,955,172	2,955,302	908	99.9693
Party List	249,722	249,672	374	99.8502
Member, House of Representatives	335,685	335,729	96	99.9714
Mayor	359,497	359,522	127	99.9647
<i>Based on 748 of 757 or 98.81% of total clustered precincts</i>			Overall Accuracy Rate	99.9493

Source: 2022 Random Manual Audit Results

9. PSA Monitoring System



Summary Report on Variance and Accuracy Rate

PHILIPPINES

(As of 24 June 2022 05:00:00 PM)

	RMA Position	Per AES	Per RMA	Variance (Difference between AES and RMA) in absolute value	Accuracy Rate
1.	President	368,991	369,052	107	99.971%
2.	Vice-President	359,080	359,128	110	99.969%
3.	Senator	2,955,172	2,955,302	908	99.969%
4.	Party List	249,722	249,672	374	99.850%
5.	Member, House of Representative	335,685	335,729	96	99.971%
6.	Mayor	359,497	359,522	127	99.965%

Overall Accuracy Rate 99.949%

Based on 748 of 757 or 98.811% of total sample clustered precincts.

10. Recommendations

The National and Local elections in the country held last May 9, 2022 was the 5th time the PSA or the NSO then participated in the Random Manual Audit of an Automated Election System. The National Statistics Office (NSO) was involved in the 2010 and 2013 and then the PSA followed in 2016, 2019, and 2022. The next RMA will be in the 2025 midterm election. If the PSA will still be part of the Random Manual Audit (RMA) Committee in 2025 then we recommend the following:

1. To improve the validation process during the data capture settings that would include validation flags and checks to ensure that inputs that even already underwent the manual validation stage from the RMA verifiers and supervisors are still be revalidated for quality results.
2. To improve the automated random selection process by also including contingency samples for city legislative districts for other reasons of not covering the original sample clustered precinct such as wrong labeling in the sample ballot box, and wet and torn ballots inside the ballot box.
3. To enhance the infrastructure (including machines and data server) needed by the PSA for real time monitoring and daily updates of RMA results.