



*"Harnessing the Power of Data and Statistics for a Future-ready Filipino and Filipina Youth"*

## **2ND PHILIPPINE DATA FESTIVAL**

03-04 October 2023 | Century Park Hotel, Malate, Manila

# **Small Area Estimation of Poverty Statistics**

**Breakout Session 1: Breaking the Chains: Leaving No One Behind**

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# Outline of the Presentation

- Background
- The SAE Methodology
- Highlights of the 2018 SAE of Poverty
- Actual Policy Uses
- Some References on SAE
- Way Forward



# Background

## WHO ARE THE POOR?

The poor are individuals and families whose income fall below the poverty threshold as defined by the NEDA and/or cannot afford in a sustained manner to provide their minimum basic needs of food, health, education, housing and other essential amenities of life.

*Section 3 of Republic Act 8425 of 1997  
(Social Reform & Poverty Alleviation Act)*

# Background

## WHY DOES PSA RELEASE POVERTY STATISTICS?




### Executive Order 352

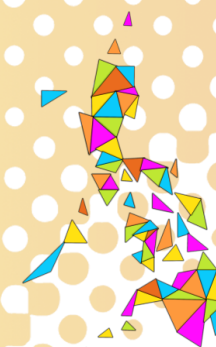
Designation of Statistical Activities that will Generate Critical Data for Decision-making of the Government and the Private Sector issued on July 1, 1996 (with regular updates from time to time)

- ☐ Technical Committee on Poverty Statistics to develop the official poverty estimation methodology
- ☐ PSA to release the Official Poverty Statistics every three years

# Background

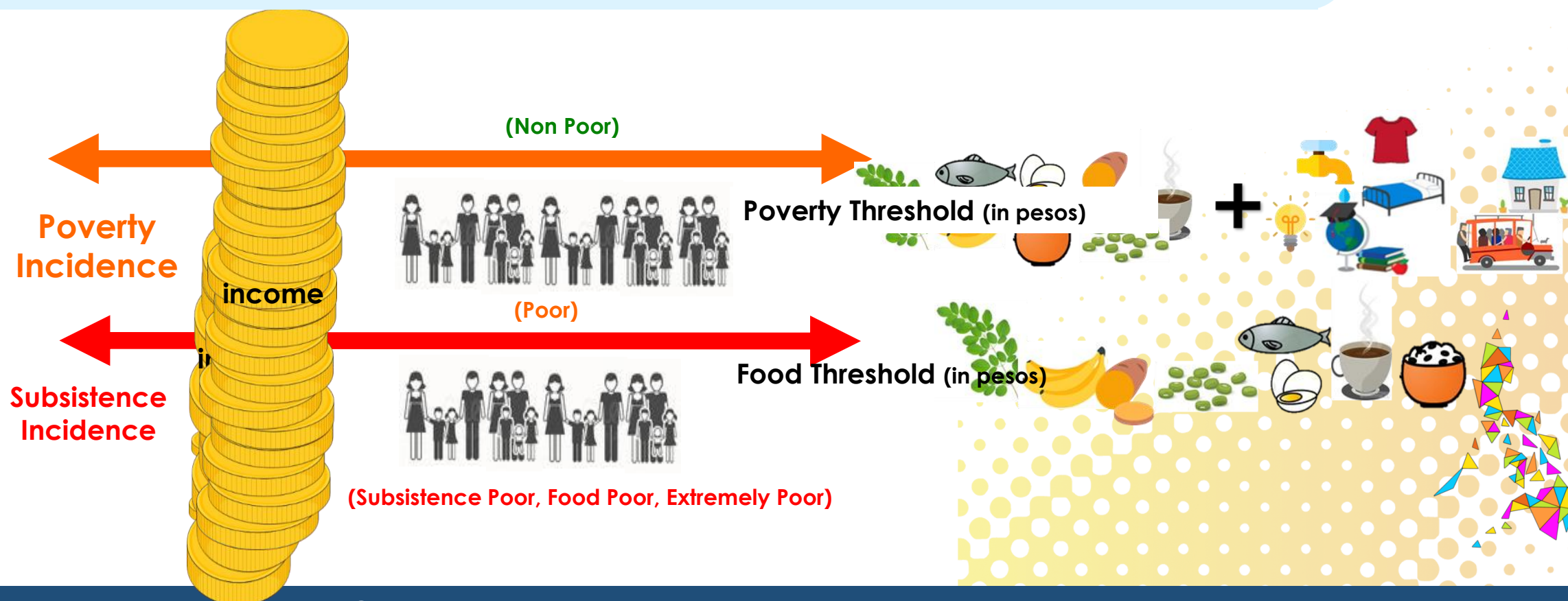
## What are the sources of data inputs?

	Data needed	Source
	Provincial food bundles	Food and Nutrition Research Institute (FNRI)
	Price data (e.g. actual provincial prices of food items)	Price Surveys of Philippine Statistics Authority (PSA)
	Income (of families/per capita)	Family Income and Expenditure Survey of PSA



# Background

How does the PSA generate official poverty statistics?

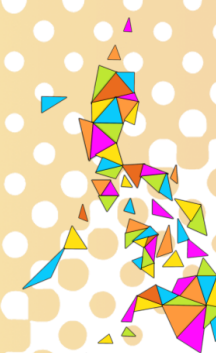




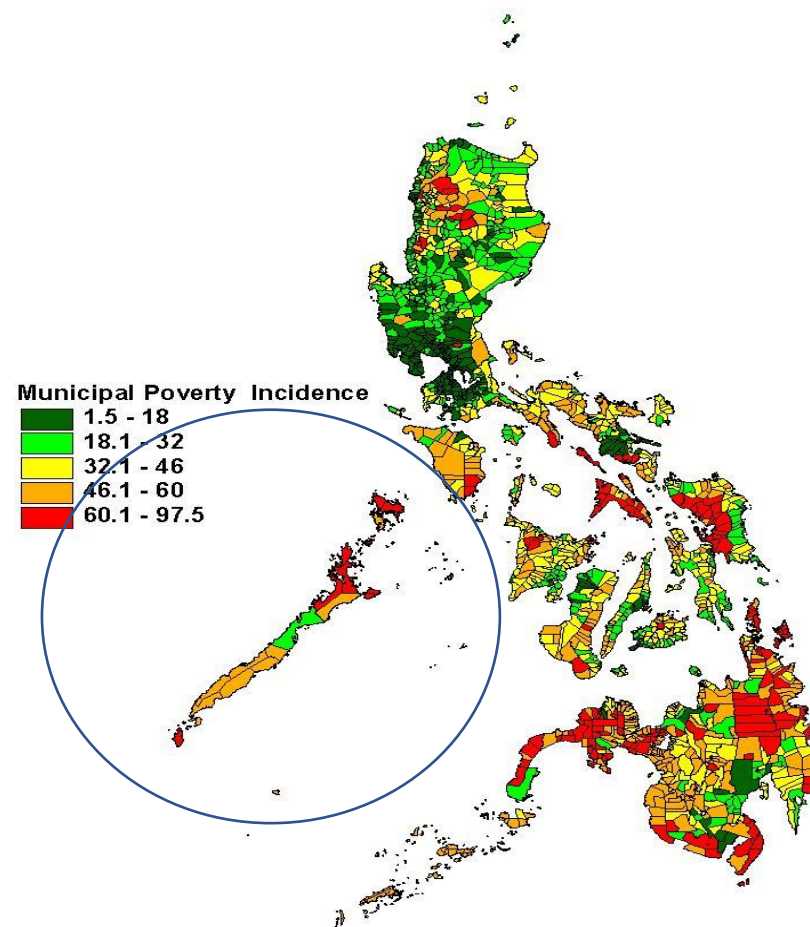
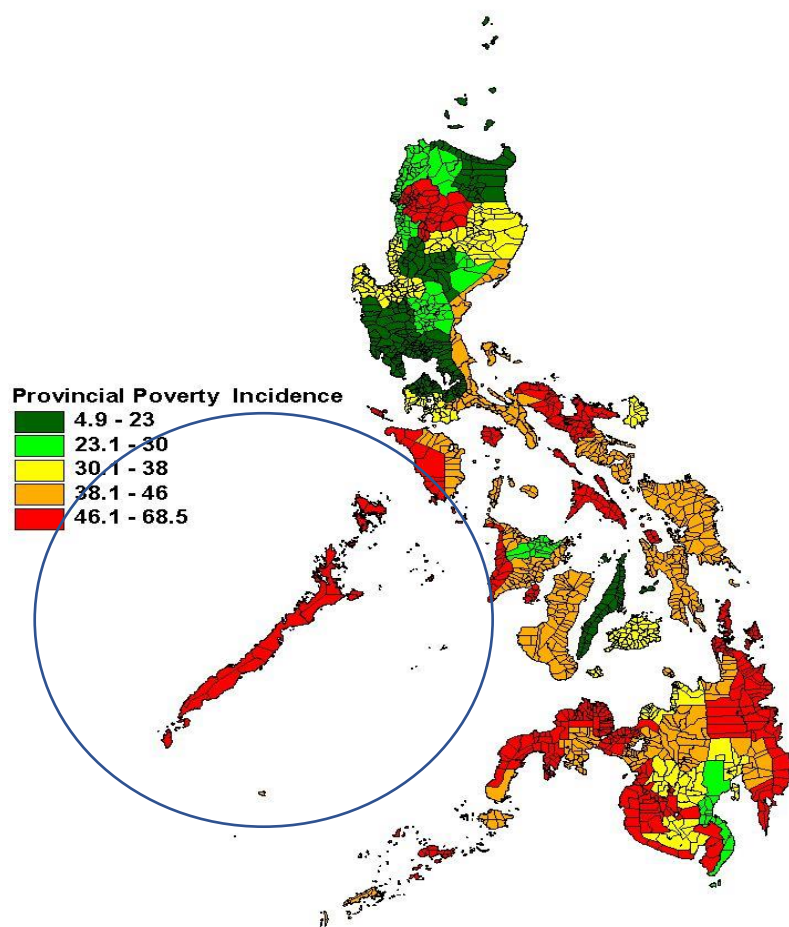
# Background

## Official Poverty Statistics

Poverty Statistics	Years Available	Level of Disaggregation
First Semester Official Poverty Statistics	2015, 2018, 2021	<ul style="list-style-type: none"> <li>National, regional, provincial, highly urbanized cities</li> </ul>
Full Year Official Poverty Statistics	2015, 2018, 2021	
Official Poverty Statistics Among the Basic Sectors	2015, 2018, 2021	<ul style="list-style-type: none"> <li>National, regional</li> <li>9 basic sectors (Farmers, fisherfolks, children, urban, women, persons with disability, youth, senior citizens and migrant and formal sector workers)</li> </ul>



# Background





# The ELL Methodology

## Small Area Estimation for Poverty Mapping

Estimation of poverty incidences at the city and municipal level



- In 2004, World Bank introduced the SAE methodology, particularly the **Elbers, Lanjouw and Lanjouw** through the “Project on the Generation of Small Area Estimates of Poverty” to the former National Statistical Coordination Board (NSCB), now part of the PSA.
- Succeeding exercises were conducted in partnership with international organizations and with support from the Philippine government



# The ELL Methodology

- Use the household survey data to estimate a model of per capita income (Y) as a function of variables that are common to both the household survey and the census (X's).
- Use the resulting estimated equation/model to predict per capita income for each household in the census.
- Unbiased estimates and standard errors of poverty incidence, poverty gap and severity of poverty for small areas, such as cities and municipalities, are then generated by using bootstrap procedure.

## Regression Model

$$\ln Y_{ij} = X_{ij}\beta + h_i + e_{ij}$$

where  $Y_{ij}$  is the target variable (per capita income) is log-transformed to make the distribution more symmetrical;

$X_{ij}$  are the household and community level characteristics;

$h_i$  is the error term held in common by the  $i^{th}$  cluster; and

$e_{ij}$  is the household level error within the cluster.



# The ELL Methodology

## Data Preparation

Variable definition, values and labels were checked for consistency

- 2021 Family Income and Expenditure Survey
- 2022 January Labor Force Survey
- 2020 Census of Population and Housing
- 2021 Updating of the List of Establishments (ULE)
- 2021 Night time lights (NTL) Data

## Model-building

"Best" Predicting Model

## Estimation

Indirect Estimation of Poverty Statistics

2021 City and Municipal Level Poverty Statistics based on SAE

Validation and Dissemination of Estimates

Model Building by Region and Model Evaluation/ Selection

Predictors of the model

Household variables

Variables from Barangay listing

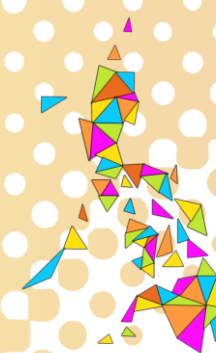
Averages at the municipal or city level

# The ELL Methodology

## Criteria in choosing the “best” model

- The relationship of the variables, whether positive or negative, on Y is **generally consistent** with earlier researches on poverty (e.g. education should have a positive effect on income).

Variable	Effect on Income
Education	+
Housing units made of strong materials	+
Family size	-
Ownership of lot	+



# The ELL Methodology

## Criteria in choosing the “best” model

- The models should be **robust**, which means that small changes to the model do not greatly affect the significance or signs of the variables.
- Estimated regional, provincial and highly urbanized cities (HUC) poverty incidence **do not largely differ from the official poverty estimates** (within 2 standard error away from the official estimates). **Preserve the ranking of the official provincial estimates within a region.**





# The ELL Methodology

## Criteria in choosing the “best” model

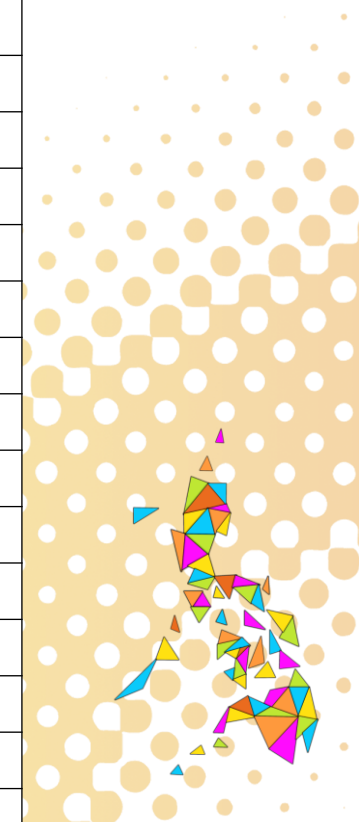
- **‘Good’ statistical properties** of the model like acceptable model adequacy; significant regression coefficients; and parsimony.
- Majority of the municipal and city level poverty estimates has **coefficient of variation (CV) less than or equal to 20%**.



# Highlights of the 2018 SAE

Adjusted  $R^2$  of the  
Regional Models: 2015  
and 2018

Region	Adjusted $R^2$	
	2015	2018
NCR <sup>1/</sup>	48.3	52.0
CAR	49.7	45.7
Region I	45.5	49.5
Region II	46.6	44.3
Region III	48.2	46.6
Region IV-A	55.6	50.7
MIMAROPA	51.5	49.8
Region V	58.2	54.5
Region VI	50.1	56.5
Region VII	50.1	52.4
Region VIII	56.3	53.3
Region IX	58.8	55.5
Region X	58.7	54.5
Region XI	57.4	53.6
Region XII	57.8	49.0
Caraga	52.7	51.3
ARMM	47.0	49.4



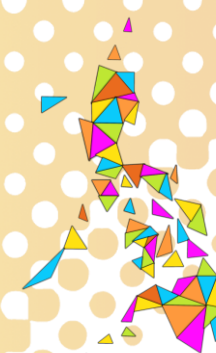
# Highlights of the 2018 SAE

## Distribution of the Municipalities and Cities, by Poverty Classification: 2015 and 2018

Poverty Classification	Poverty Incidence Among Population (%)	2015 <sup>1/</sup>	2018 <sup>2/</sup>
Level 1	At most 20.0	614	773
Level 2	>20.0 to 40.0	603	636
Level 3	>40.0 to 60.0	349	103
Level 4	>60.0 to 80.0	78	81
Level 5	Greater than 80.0	0	18
<b>TOTAL</b>		<b>1,644</b>	<b>1,611</b>

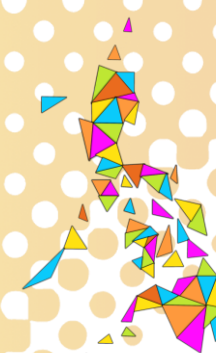
Notes: 1/ Still used the poverty thresholds released in October 2016 where the food thresholds were still based on the Consumer Price Index (CPI) market basket of prices for 2006. Excludes estimates for the Cities of Isabela in Region IX and Cotabato in Region XII.

2/ Excludes the estimates for the highly urbanized cities, and the Cities of Isabela in Region IX and Cotabato in Region XII. Their estimates are available in the 2018 Official Poverty Statistics.



## 20 Poorest Cities/Municipalities in 2018

City/Municipality	Province	2015		2018	
		Poverty Incidence	Coefficient of Variation	Poverty Incidence	Coefficient of Variation
Pagayawan (Tatarikan)	Lanao del Sur	73.2	9.1	89.6	2.9
Kapai	Lanao del Sur	73.6	8.5	88.9	2.7
Sultan Dumalondong	Lanao del Sur	70.9	11.9	88.1	4.9
Pata	Sulu	59.4	14.3	87.3	3.8
Picong (Sultan Gumander)	Lanao del Sur	71.4	7.8	86.6	3.3
Marogong	Lanao del Sur	72.5	9.5	86.6	3.6
Calanogas	Lanao del Sur	68.5	10.5	86.1	3.2
Tabuan-Lasa	Basilan	62.2	14.3	85.9	4.1
Panglima Estino (New Panamao)	Sulu	62.8	16.4	85.4	4.5
Kapatagan	Lanao del Sur	62.6	12.2	85.2	3.3
Tagoloan II	Lanao del Sur	78.2	8.9	85.0	3.1
Old Panamao	Sulu	59.7	14.2	84.7	3.5
Piagapo	Lanao del Sur	68.1	8.4	83.9	2.5
Talipao	Sulu	58.1	9.9	82.6	2.4
Lumbaca-Unayan	Lanao del Sur	68.7	11.2	82.3	4.7
Hadji Mohammad Ajul	Basilan	56.1	15.2	81.6	6.5
Butig	Lanao del Sur	65.1	11.6	80.7	5.4
Tongkil	Sulu	51.3	16.9	80.7	4.8
Omar	Sulu	53.6	19.4	79.4	6.1
Kalingalan Caluang	Sulu	49.2	19.7	78.7	6.3



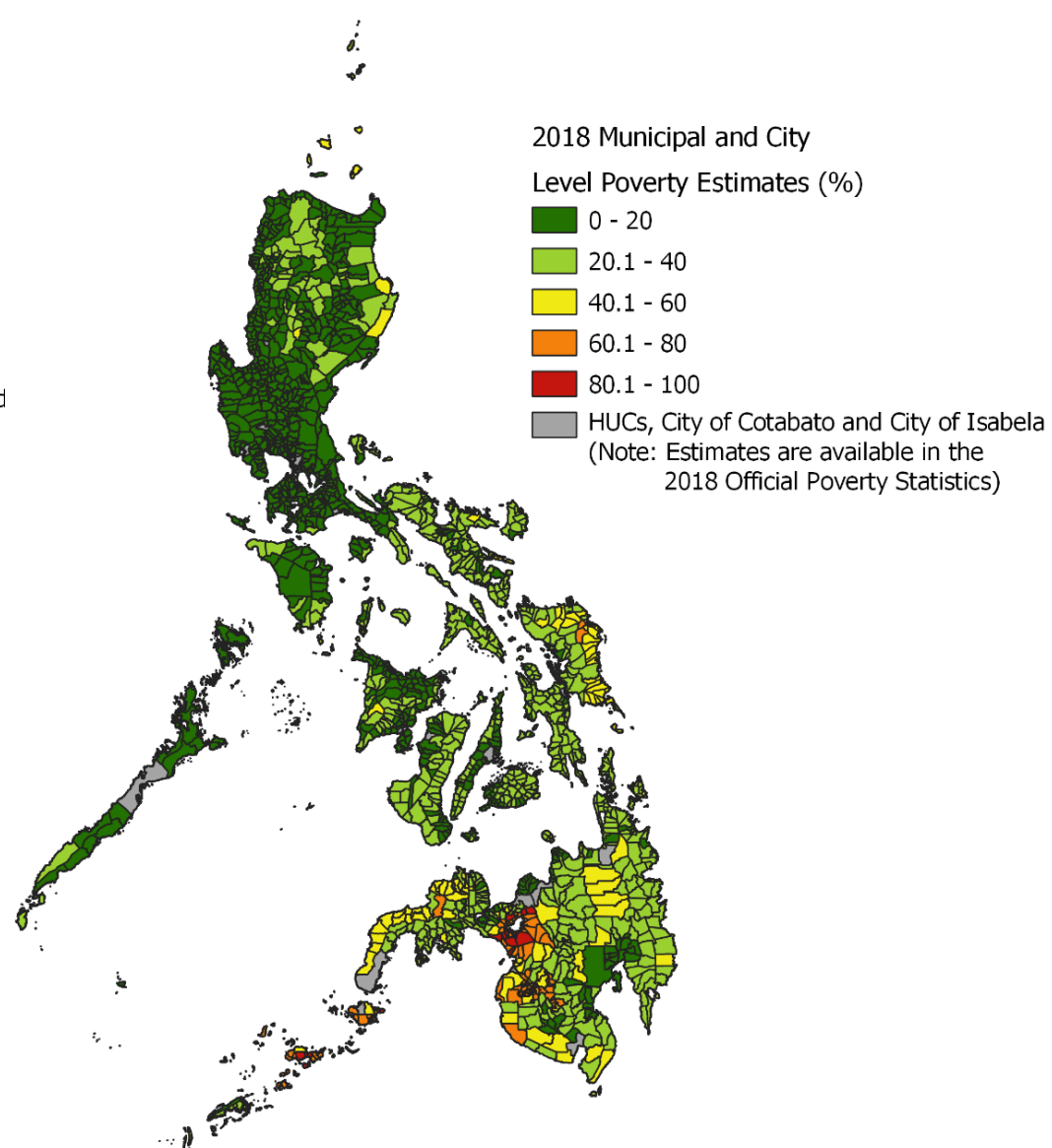
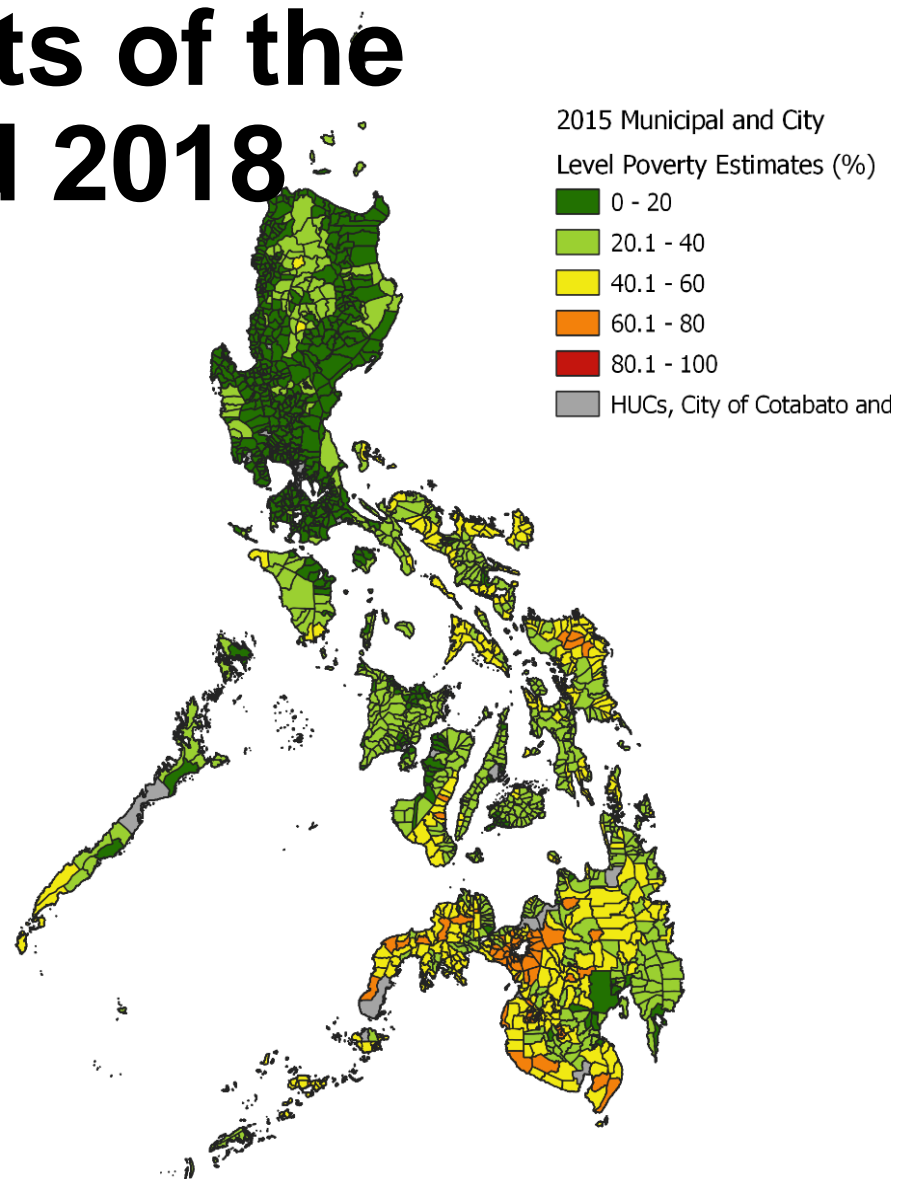
## 20 Least Poor Cities/Municipalities in 2018

City/Municipality	Province	2015		2018	
		Poverty Incidence	Coefficient of Variation	Poverty Incidence	Coefficient of Variation
San Fernando City	La Union	3.8	16.2	1.3	29.9
Santa Rosa City	Laguna	2.4	30.8	1.3	31.0
Bacnotan	La Union	5.3	15.0	1.5	30.8
Binondo	City of Manila	3.5	22.8	1.5	23.0
Cabuyao City	Laguna	8.5	9.0	1.5	30.3
Rizal	Laguna	3.0	30.4	1.6	30.1
Los Baños	Laguna	2.1	30.8	1.6	26.8
Biñan City	Laguna	5.2	11.8	1.7	31.4
San Juan	La Union	5.5	16.5	1.8	29.7
Paco	City of Manila	3.2	13.5	1.9	13.9
Calamba City	Laguna	3.0	17.4	1.9	15.5
Sampaloc	City of Manila	2.7	9.2	2.0	9.6
Santa Cruz	Laguna	4.6	24.1	2.0	22.7
San Pedro City	Laguna	2.7	25.3	2.0	22.1
Liliw	Laguna	3.9	22.7	2.1	23.3
San Pablo City	Laguna	4.2	14.4	2.1	12.4
Pandacan	City of Manila	3.6	14.4	2.2	13.0
Bay	Laguna	2.7	14.7	2.2	25.1
Lumban	Laguna	7.9	24.3	2.3	29.3
La Trinidad	Benguet	2.1	18.9	2.3	21.7





# Highlights of the 2015 and 2018 SAE



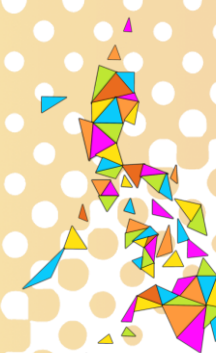
# Highlights of the 2018 SAE

Distribution of the Municipalities and Cities  
based on the Coefficient of Variation of the Estimates: 2015 and 2018

Type of Estimates	Coefficient of Variation (%)	2015 <sup>1/</sup>			2018 <sup>2/</sup>		
		Count	%	< RCF	Count	%	< RCF
Reliable	At most 10.0	529	32.2	32.2	567	35.2	35.2
With acceptable measure of reliability	> 10.0 but ≤ 20.0	932	56.7	88.9	874	54.3	89.4
Unreliable	> 20.0 but ≤ 30.0	163	9.9	98.8	135	8.4	97.8
	> 30.0 but ≤ 40.0	16	1.0	99.8	29	1.8	99.6
	> 40.0 but ≤ 60.0	4	0.2	100.0	4	0.2	99.9
	> 60				2	0.1	100.0
TOTAL		1,644	100.0		1,611	100.0	

Notes: 1/ Still used the poverty thresholds released in October 2016 where the food thresholds were still based on the Consumer Price Index (CPI) market basket of prices for 2006. Excludes estimates for the Cities of Isabela in Region IX and Cotabato in Region XII.

2/ Excludes the estimates for the highly urbanized cities, and the Cities of Isabela in Region IX and Cotabato in Region XII. Their estimates are available in the 2018 Official Poverty Statistics.



# Highlights of the 2018 SAE

## 2018 Nighttime Lights Data of the Earth Observation Group (EOG) of the Colorado School of Mines



Nighttime Lights  
≈  
Economic Activity

<https://eogdata.mines.edu/products/vn/>

1. Download link:

[https://eogdata.mines.edu/nighttime\\_light/annual/v21/](https://eogdata.mines.edu/nighttime_light/annual/v21/)

2. Satellite image file:

[https://eogdata.mines.edu/nighttime\\_light/annual/v21/2021/VNL\\_v21\\_npp\\_2021\\_global\\_vcmslcfg\\_c202205302300.average.d  
at.tif.gz](https://eogdata.mines.edu/nighttime_light/annual/v21/2021/VNL_v21_npp_2021_global_vcmslcfg_c202205302300.average.dat.tif.gz)



# Highlights of the 2018 SAE – Region IX

Comparison of Final Set of Independent Variables with and without Mean Luminosity Variable

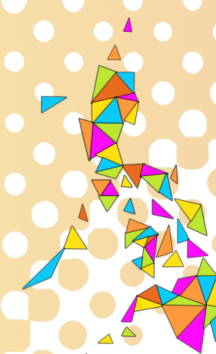
Region/ Province/ HUC	2018 Official PovStat		$2\sigma$	With Mean Luminosity		Without Mean Luminosity	
	2018 Official	SE		2018 SAE	Difference (Official-SAE)	2018 SAE	Difference (Official-SAE)
Zamboanga Peninsula	32.7	1.3	2.6	30.9	1.8	30.0	2.7
Zamboanga Del Norte	45.4	3.0	6.0	44.4	1.0	42.7	2.7
Zamboanga Del Sur	23.7	1.7	3.4	22.3	1.4	21.9	1.8
Zamboanga Sibugay	35.4	2.6	5.2	32.5	2.9	31.7	3.7
City of Isabela	51.0	3.7	7.4	43.8	7.2	42.6	8.4
Zamboanga City	10.2	1.2	2.4	12.7	2.5	14.0	3.8

# Highlights of the 2018 SAE – Region IX

## Comparison of Final Set of Independent Variables with and without Mean Luminosity Variable

### Distribution of CVs

Grouping	With Mean Luminosity Variable	Without Mean Luminosity Variable
Less than 10	50	38
10 to 20	22	33
20 to 30	0	1
More than 30	0	0





# Actual Policy Uses

## A. In policy formulation, planning and monitoring

National/Local Government Unit	Actual Policy Uses
Municipality of Nabas in Aklan	<ul style="list-style-type: none"><li>• development of municipal economic profile and local planning in the area</li><li>• poverty estimates served as basis for formulating poverty reduction program in the area</li></ul>
Provincial Government of Negros Occidental	<ul style="list-style-type: none"><li>• development of provincial economic profile</li></ul>
Provincial Government of Pangasinan	<ul style="list-style-type: none"><li>• used the 2006, 2009 and 2012 small area estimates of poverty in the assessment of the progress of municipalities in the implementation of poverty reduction programs</li></ul>



# Actual Policy Uses

## A. In policy formulation, planning and monitoring

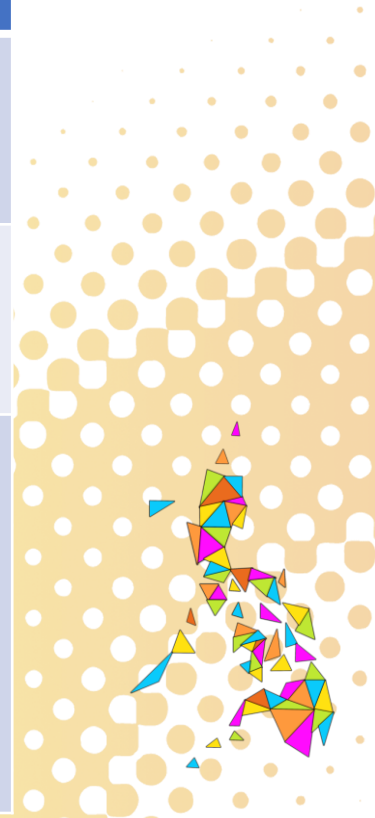
National/Local Government Unit	Actual Policy Uses
<b>NEDA/Regional Development Council in CAR</b>	<ul style="list-style-type: none"><li>• used SAE in preparing the profile and situationer of the BLISTT areas (Baguio, La Trinidad, Itogon, Sablan, Tuba and Tublay) during the BLISTT master planning activity</li><li>• In the presentation and analysis of the region's poverty and macro-economy situationer, the SAE is used in identifying areas needing poverty reduction programs.</li></ul>
<b>Municipality of San Francisco, Isabela MPDO</b>	<ul style="list-style-type: none"><li>• Development of municipal economic profile</li></ul>



# Actual Policy Uses

## B. Targeting beneficiaries of programs

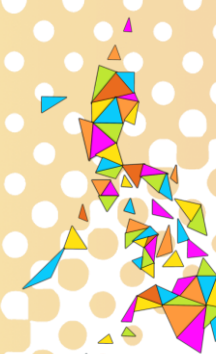
National/Local Government Unit	Actual Policy Uses
<b>Department of Social Welfare and Development (DSWD) in Western Visayas</b>	<ul style="list-style-type: none"> <li>used for the Phase II of the Pantawid Pamilyang Piipino Program (4P's) in Western Visayas</li> </ul>
<b>DSWD-CAR</b>	<ul style="list-style-type: none"> <li>used as a guide for the 2nd round of the National Household Targeting System (NHTS) operations</li> </ul>
<b>Department of Agriculture (DA)</b>	<ul style="list-style-type: none"> <li>used in the Panay Island Sustainable Agricultural Upland Development Project as basis to determine recipients of the projects in the pilot communities in order to address the upland communities' need for nutritious and healthy food by building the capability of people in implementing upland agricultural and forest development programs</li> </ul>



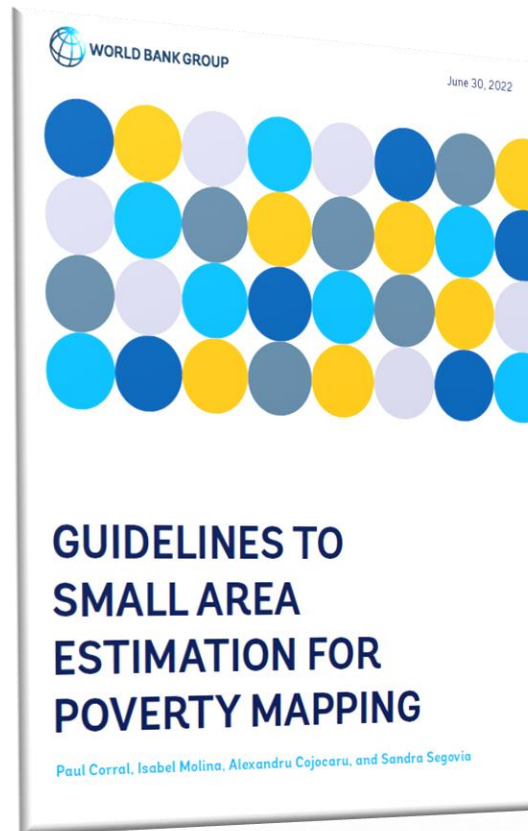
# Actual Policy Uses

## B. Targeting beneficiaries of programs

National/Local Government Unit	Actual Policy Uses
DA	<ul style="list-style-type: none"><li>used the SAE on Poverty for determining top priority LGUs in Region VI as recipients of the Philippine Rural Development Project (PRDP) funded by World Bank in partnership with the LGUs and the private sector</li></ul>
UN-WFP Program of DSWD	<ul style="list-style-type: none"><li>used in identifying affected families of typhoon Yolanda for prioritization in Western Visayas.</li></ul>
National Commission on Indigenous Peoples (Region IV-A)	<ul style="list-style-type: none"><li>Serve as input/reference to the Educational Assistance Program (EAP)</li><li>Specifically, for the computation of equitable distribution of funds for the EAP</li></ul>

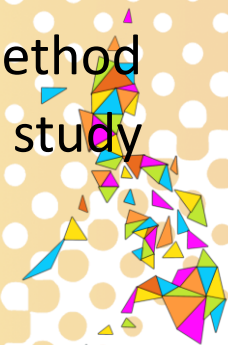


# Some References on SAE



The **WORLD BANK** launched the publication on Guidelines to Small Area Estimation for Poverty Mapping last year.

This caps more than two decades of poverty mapping experience of the World Bank since the launch of an innovative method combining census and survey data to study the spatial dimensions of poverty.



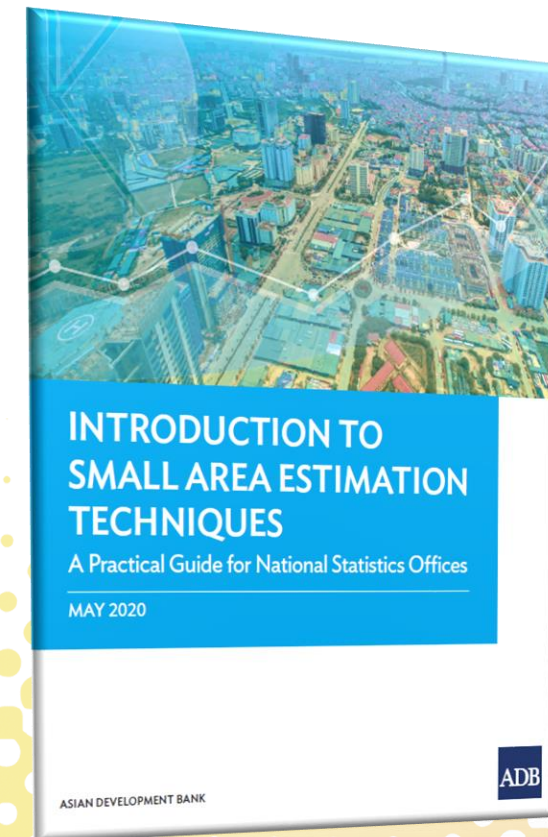


# Some References on SAE

## INTRODUCTION TO SMALL AREA ESTIMATION TECHNIQUES A Practical Guide for National Statistics Offices

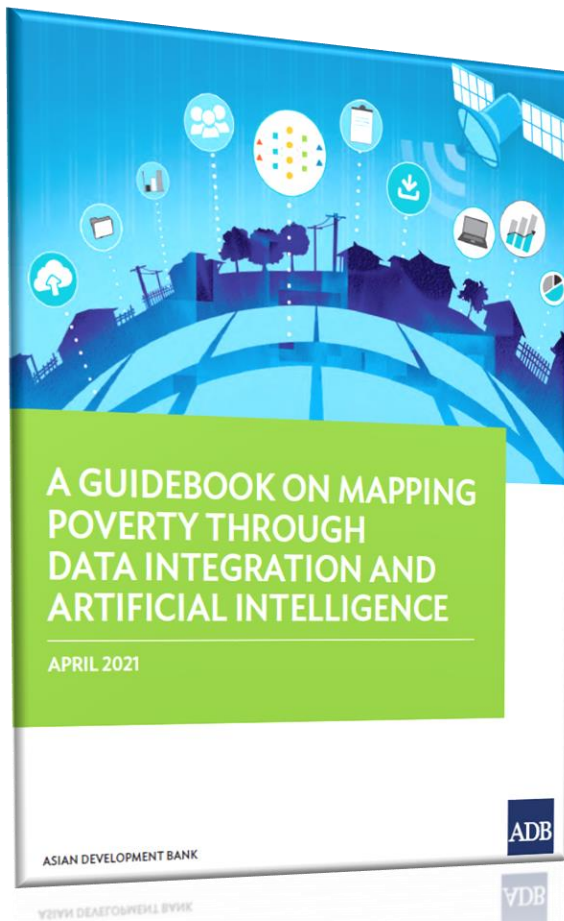


This guide is an introduction to basic SAE techniques and describes the implementation of these techniques using R software.





# Some References on SAE



## A GUIDEBOOK ON MAPPING POVERTY THROUGH DATA INTEGRATION AND ARTIFICIAL INTELLIGENCE



This guide documents the results of using computer vision techniques to map the spatial distribution of poverty in the Philippines and Thailand which entails training a convolutional neural network (CNN). The trained CNN and ridge parameters can then be used to predict poverty using only a daytime image as input.



# Way Forward

- Generation of 2021 Small Area Estimates of Poverty and targeted to be release in a Dissemination Forum in October this year
- Requested to generate SAE of Poverty for congressional district levels
- Biennial conduct of the SAE of Poverty since the FIES will be conducted every two years
- Approval of the official methodology for generating SAE of Poverty





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# Thank you!



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