



# Small Area Estimation of Poverty through Non-conventional Data

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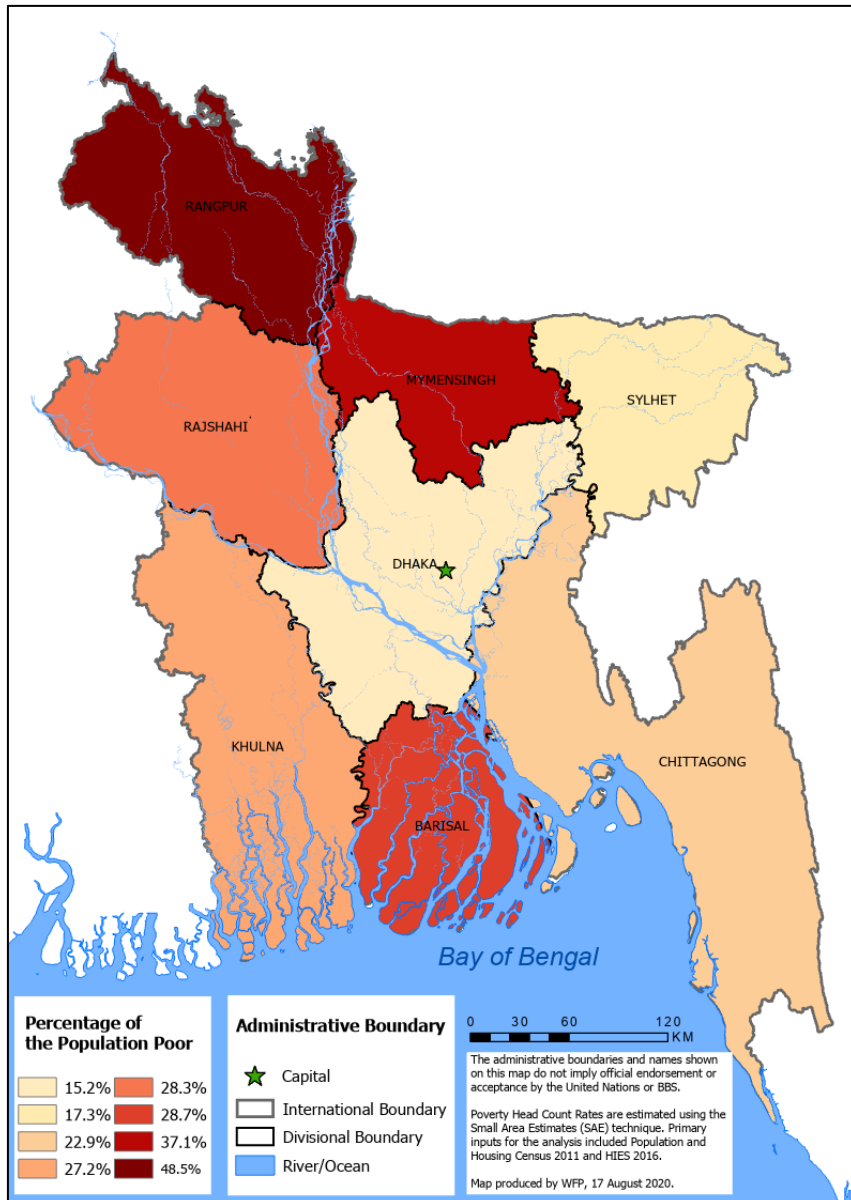
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International Workshop on the Monitoring of the Sustainable  
Development Goals | 12-13 January 2022

# Poverty Monitoring in Bangladesh

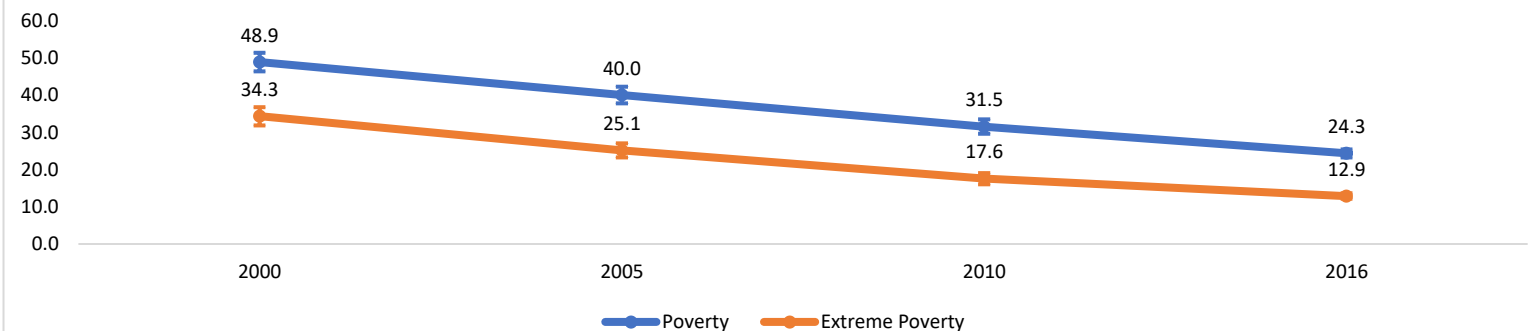


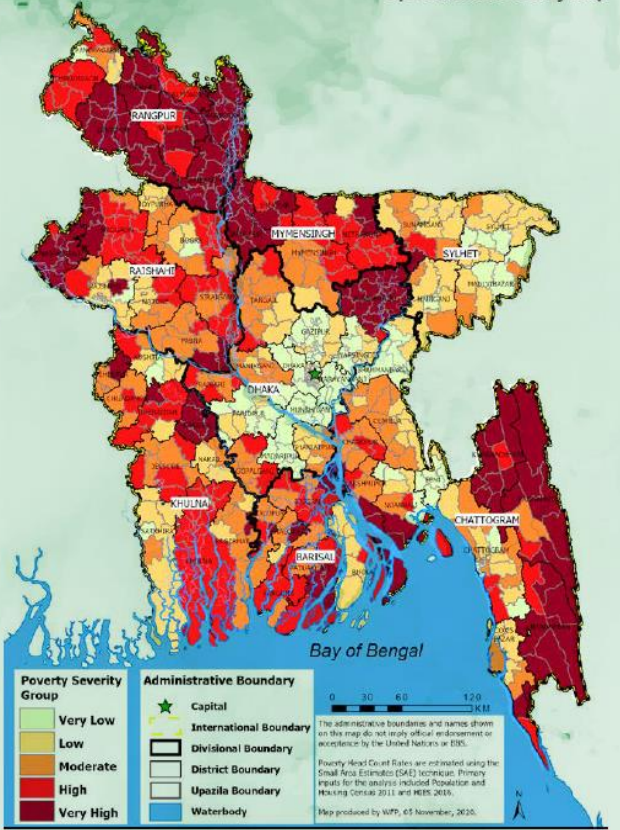
## Direct Estimation

Household Income and Expenditure Survey up to Division level:

- To Measure the Poverty Situation of a Country
- To know about the household income, expenditure and consumption status

Poverty and Extreme Poverty Headcount rates (%), 2000 to 2016





# Poverty Monitoring in Bangladesh

## Indirect Estimations

### Small Area Estimation:

- ❖ Due to the limited sample size in HIES it can't produce reliable estimates beyond Division/District level.
- ❖ Demand from planners, policymakers and other users for more disaggregated level poverty estimates are increasing day by day.
- ❖ World Bank Method (Elbers, Lanjouw and Lanjouw, 2003)

### Growth Elasticity of Poverty (GEP):

- ❖ For National estimate of poverty, BBS projects the national level poverty rate following Growth Elasticity of Poverty for the interval years of HIES.





# DATA FOR NOW

**2019**

**AGGREGATION:  
BUILDING POLITICAL  
SUPPORT  
AND MOMENTUM**

**2020-21**

**AMPLIFICATION:  
IN-DEPTH BROKERING,  
EMPOWERING PARTNERSHIPS  
AND SCALING INITIATIVES**

**2022-23**

**SCALE-UP:  
WIDESPREAD RESULTS,  
DEMONSTRATION OF IMPACT  
AND EXPANSION**

# The Data for Now initiative at a Glance

Supports countries in the use of **innovative sources, technologies** and **methods** for the streamlined production and dissemination of better, more timely and disaggregated data for sustainable development.

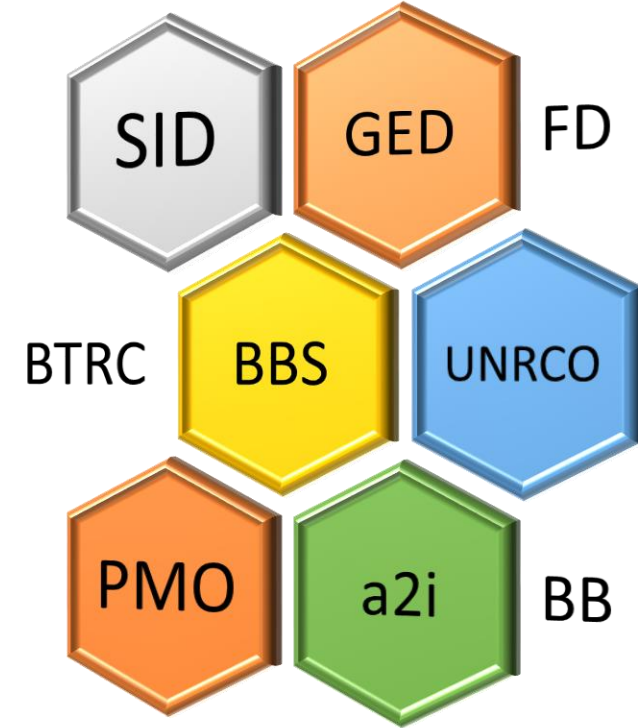
Is co-led by the United Nations Statistics Division, the World Bank, the Global Partnership for Sustainable Development Data, and the Sustainable Development Solutions Network

**Bangladesh**, Nepal, Mongolia, Paraguay, Colombia, Ghana, Rwanda and Senegal joined the initiative in September 2019

Bangladesh Bureau of Statistics (BBS) is the lead of the project at the national level, with the active participation and engagement of National and international Stakeholders, such as: Aspire to Innovate (a2i), Poverty estimation Working Group, UN Data Group, UNRCO

# Composition of Working Team of Poverty Estimation

- Bangladesh Bureau of Statistics (BBS)
- General Economics Division (GED)
- Finance Division (FD)
- Bangladesh Bank (BB)
- Bangladesh Telecommunication Regulatory Commission (BTRC)
- Aspire to Innovate (a2i) Programme
- Statistics and Informatics Division
- Prime Minister's Office
- United Nations Resident Coordinator Office (UNRCO)



# Objective of the Exercise

- To develop a model for Small Area Estimation of poverty using various non-conventional data for the year of 2016.
- To compare the indirect poverty estimates derived from Small Area Estimation with direct Estimates through Household Income Expenditure Survey 2016.
- To replicate the model for new estimation of poverty for the year of 2021 using non-conventional data.
- To build the capacity in estimating Poverty using non-conventional data including spatial data.

### 1<sup>st</sup> Workshop

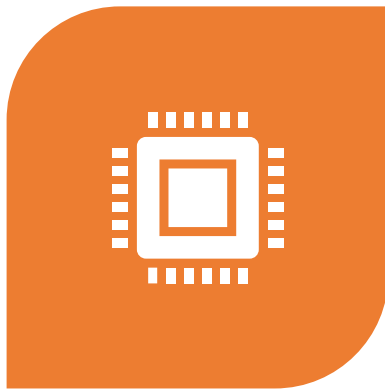
Big Data for  
Poverty  
Estimation, Non-  
conventional data,  
Country Practices  
of Poverty  
Mapping, Mobile  
data for poverty  
estimate

### 2<sup>nd</sup> Workshop

Hands-on  
Training and  
Exercise for  
model  
development  
using Non-  
conventional  
data



# Platforms Used



GOOGLE EARTH ENGINE  
(GEE),

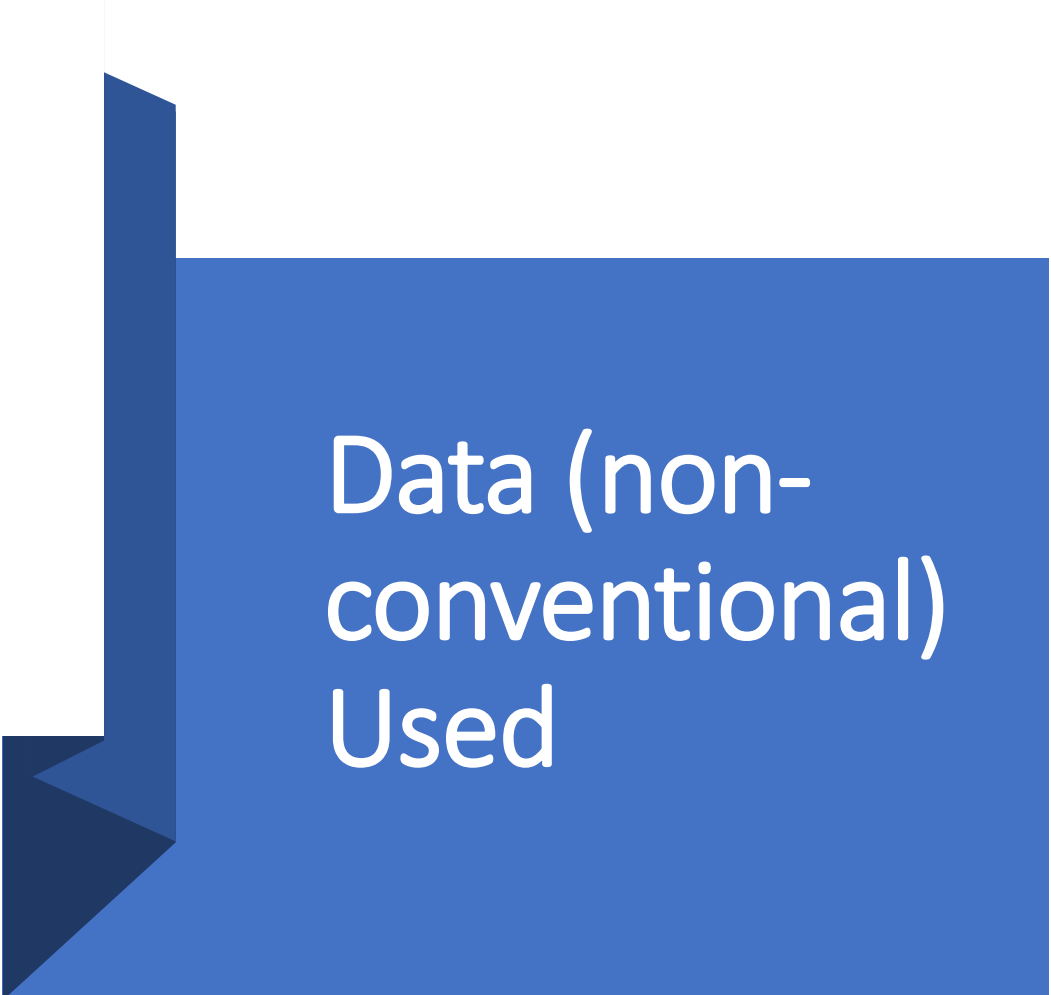


GEOGRAPHIC INFORMATION  
SYSTEM (GIS)

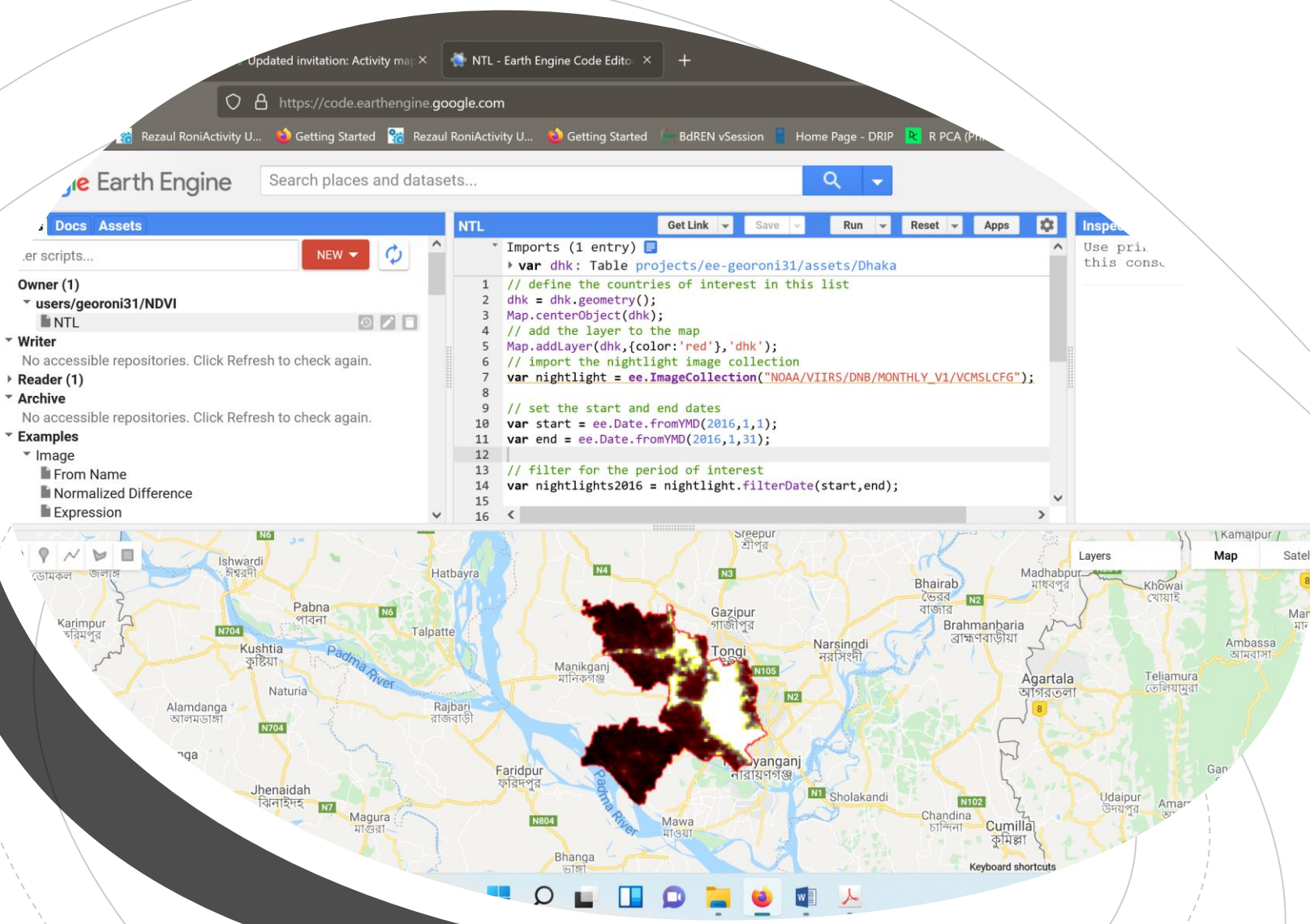


PROGRAMMING LANGUAGE  
R.

Data Type	Description	Platforms
Raster	Night Time Light (NTL) data	Google Earth Engine
Vector	Road Network, Educational Institutions, etc.	ArcMap
Tabular	Agricultural Crop Production 2016	Programming language R

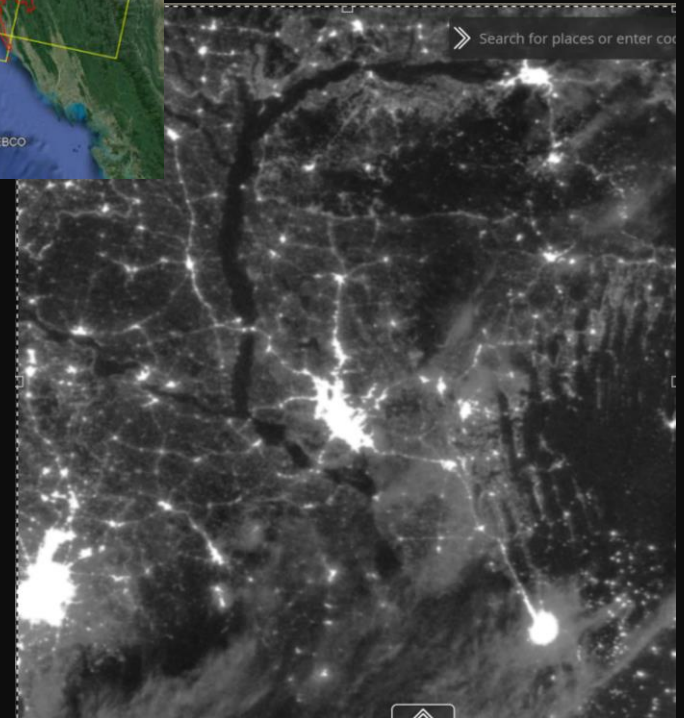
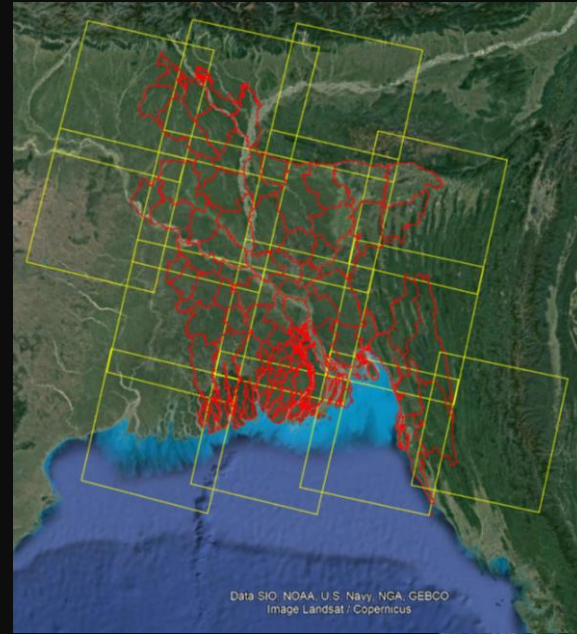


Data (non-  
conventional)  
Used



# Night Time Light (NTL) data Extraction From GEE

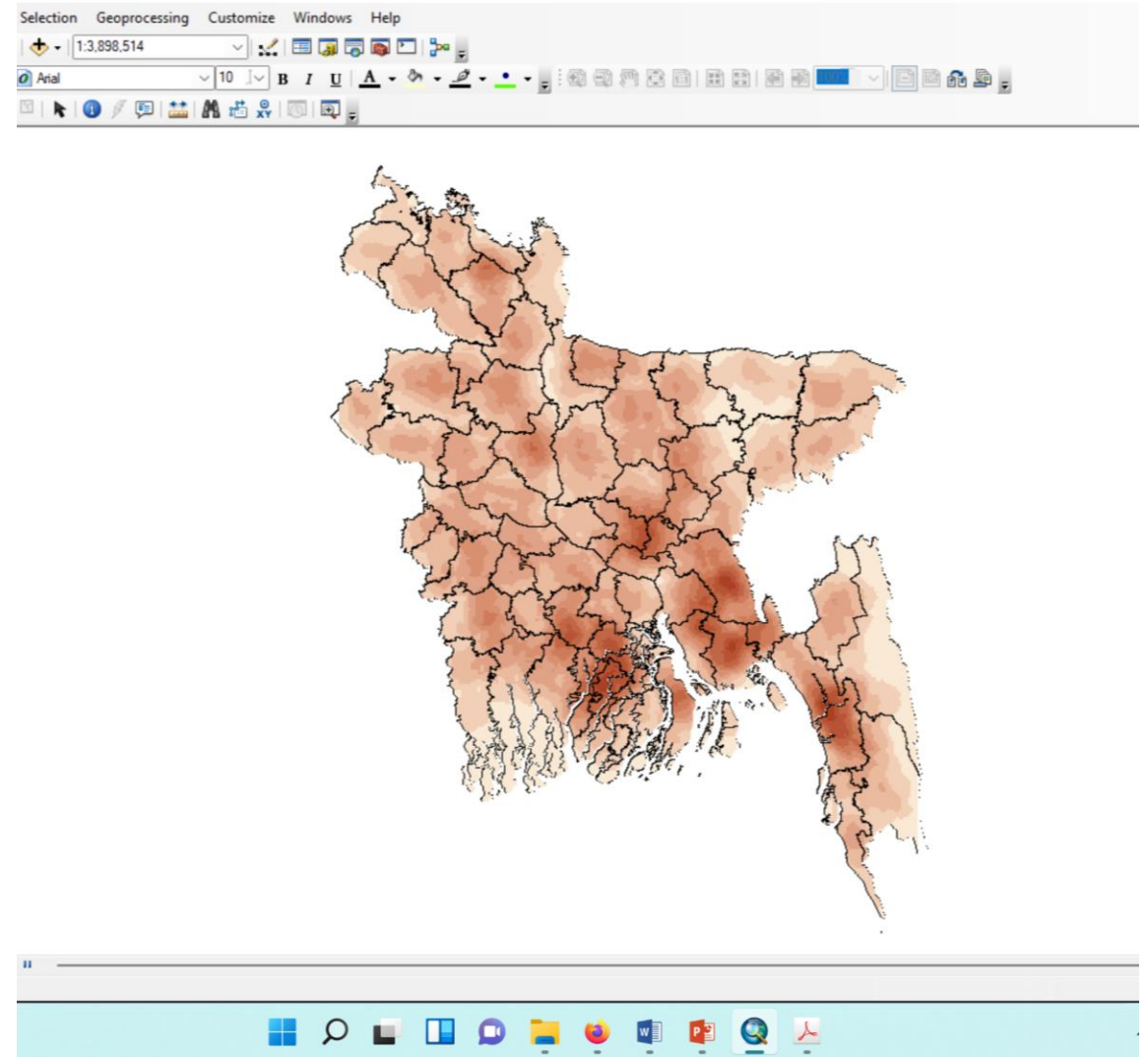
# Night Time Light (NTL) Data



# GIS Platform

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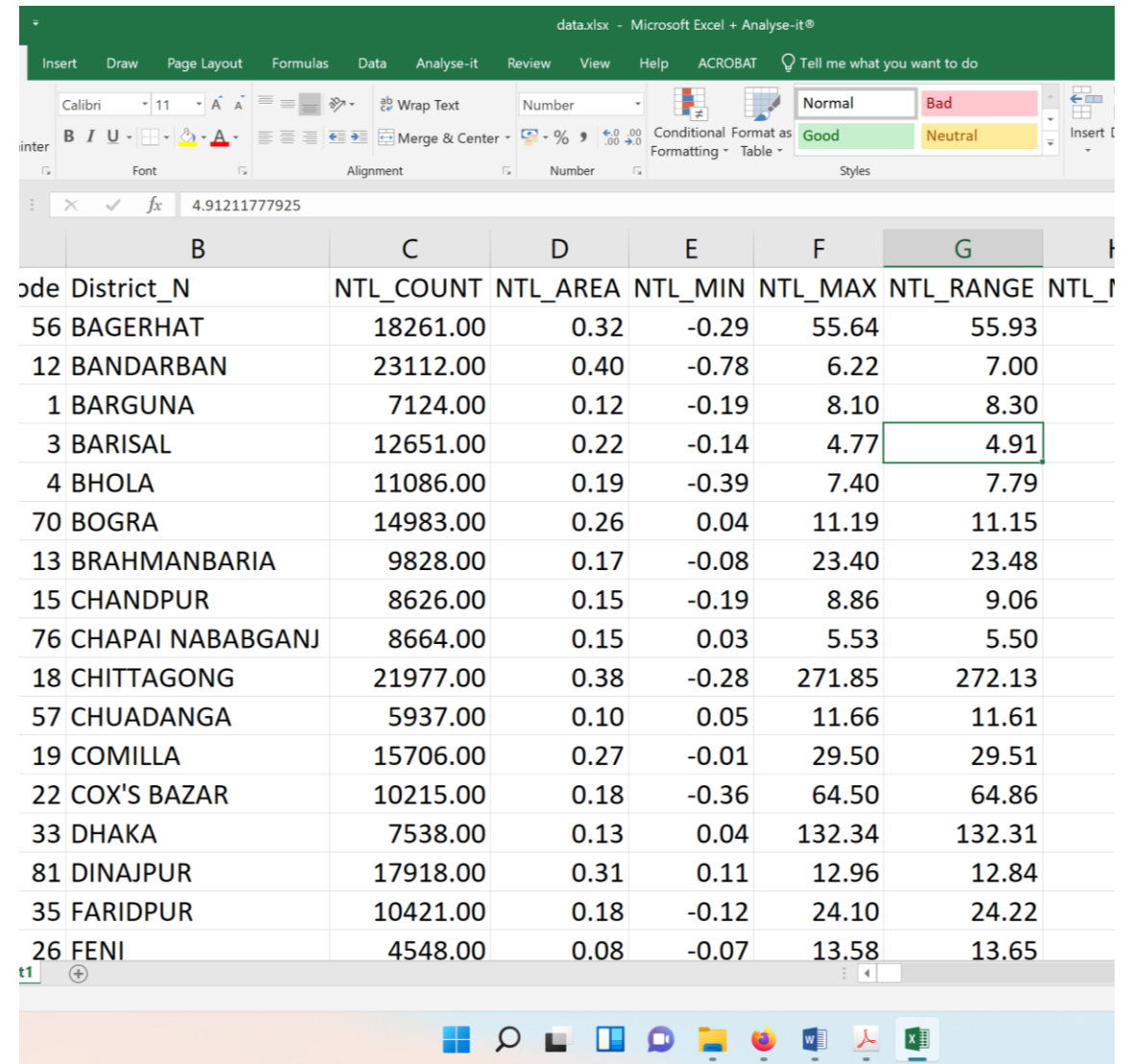
- Density Statistics extraction



# Extracted Data from NTL

- Six Statistics –
  - COUNT
  - SUM
  - MIN
  - MAX
  - MEAN
  - STD

against the light intensity and other non-conventional data



The screenshot shows a Microsoft Excel spreadsheet with the following data:

Code	District_N	NTL_COUNT	NTL_AREA	NTL_MIN	NTL_MAX	NTL_RANGE	NTL_I
56	BAGERHAT	18261.00	0.32	-0.29	55.64	55.93	
12	BANDARBAN	23112.00	0.40	-0.78	6.22	7.00	
1	BARGUNA	7124.00	0.12	-0.19	8.10	8.30	
3	BARISAL	12651.00	0.22	-0.14	4.77	4.91	
4	BHOLA	11086.00	0.19	-0.39	7.40	7.79	
70	BOGRA	14983.00	0.26	0.04	11.19	11.15	
13	BRAHMANBARIA	9828.00	0.17	-0.08	23.40	23.48	
15	CHANDPUR	8626.00	0.15	-0.19	8.86	9.06	
76	CHAPAI NABABGANJ	8664.00	0.15	0.03	5.53	5.50	
18	CHITTAGONG	21977.00	0.38	-0.28	271.85	272.13	
57	CHUADANGA	5937.00	0.10	0.05	11.66	11.61	
19	COMILLA	15706.00	0.27	-0.01	29.50	29.51	
22	COX'S BAZAR	10215.00	0.18	-0.36	64.50	64.86	
33	DHAKA	7538.00	0.13	0.04	132.34	132.31	
81	DINAJPUR	17918.00	0.31	0.11	12.96	12.84	
35	FARIDPUR	10421.00	0.18	-0.12	24.10	24.22	
26	FENI	4548.00	0.08	-0.07	13.58	13.65	

# Model development in R

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins
Project (None)
Environment History Connections Tutorial
Data_2020 <- read_excel("C:/Data/Poverty_GIS_RS/View(Data_2020)
predict(model, data=Data_2020)
newmodel <- predict(model, data=Data_2020)
write.xlsx(newmodel, file, sheetName = "Sheet1_
model <- lm(Pov_rate~ NTL_MEAN+NTL_STD+NTL_SUM+P_SUM+Rd_MEAN+Rd_SUM+wheat_16+Boro_16+Aus_16+Aman_16)
Error in eval(predvars, data, env) : object 'Pov_rate' not found
> model <- lm(Pov_rate~ NTL_MEAN+NTL_STD+NTL_SUM+P_SUM+Rd_MEAN+Rd_SUM+wheat_16+Boro_16+Aus_16+Aman_16, data = data)
> summary(model)

Call:
lm(formula = Pov_rate ~ NTL_MEAN + NTL_STD + NTL_SUM + P_SUM +
    Rd_MEAN + Rd_SUM + wheat_16 + Boro_16 + Aus_16 + Aman_16,
    data = data)

Residuals:
    Min       1q   Median       3q      Max
-20.641  -9.959  -3.250   8.946  38.335

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.691e+01  7.318e+00  2.311  0.0247 *
NTL_MEAN     5.375e+00  4.834e+00  1.112  0.2712
NTL_STD      1.502e+00  1.883e+00  0.798  0.4285
NTL_SUM     -9.855e-04  7.001e-04 -1.408  0.1651
P_SUM       5.047e-06  2.887e-06  1.748  0.0863 .
Rd_MEAN     -2.642e-01  4.484e-01 -0.589  0.5582
Rd_SUM      3.189e-04  1.008e-03  0.316  0.7529
wheat_16    8.334e-06  5.319e-05  0.157  0.8761
Boro_16     2.688e-06  1.333e-05  0.202  0.8410
Aus_16     -9.977e-05  5.644e-05 -1.767  0.0829 .
Aman_16     2.970e-05  2.191e-05  1.355  0.1810
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 15.07 on 53 degrees of freedom
(1 observation deleted due to missingness)
Multiple R-squared:  0.1856, Adjusted R-squared:  0.03193
F-statistic: 1.208 on 10 and 53 DF, p-value: 0.3075

> newmodel <- predict(model, data=Data_2020)
> summary(newmodel)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 12.42  22.65  27.29  27.45  31.93  43.35
> newmodel <- predict(model, data=Data_2020)
> summary(newmodel)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 12.42  22.65  27.29  27.45  31.93  43.35

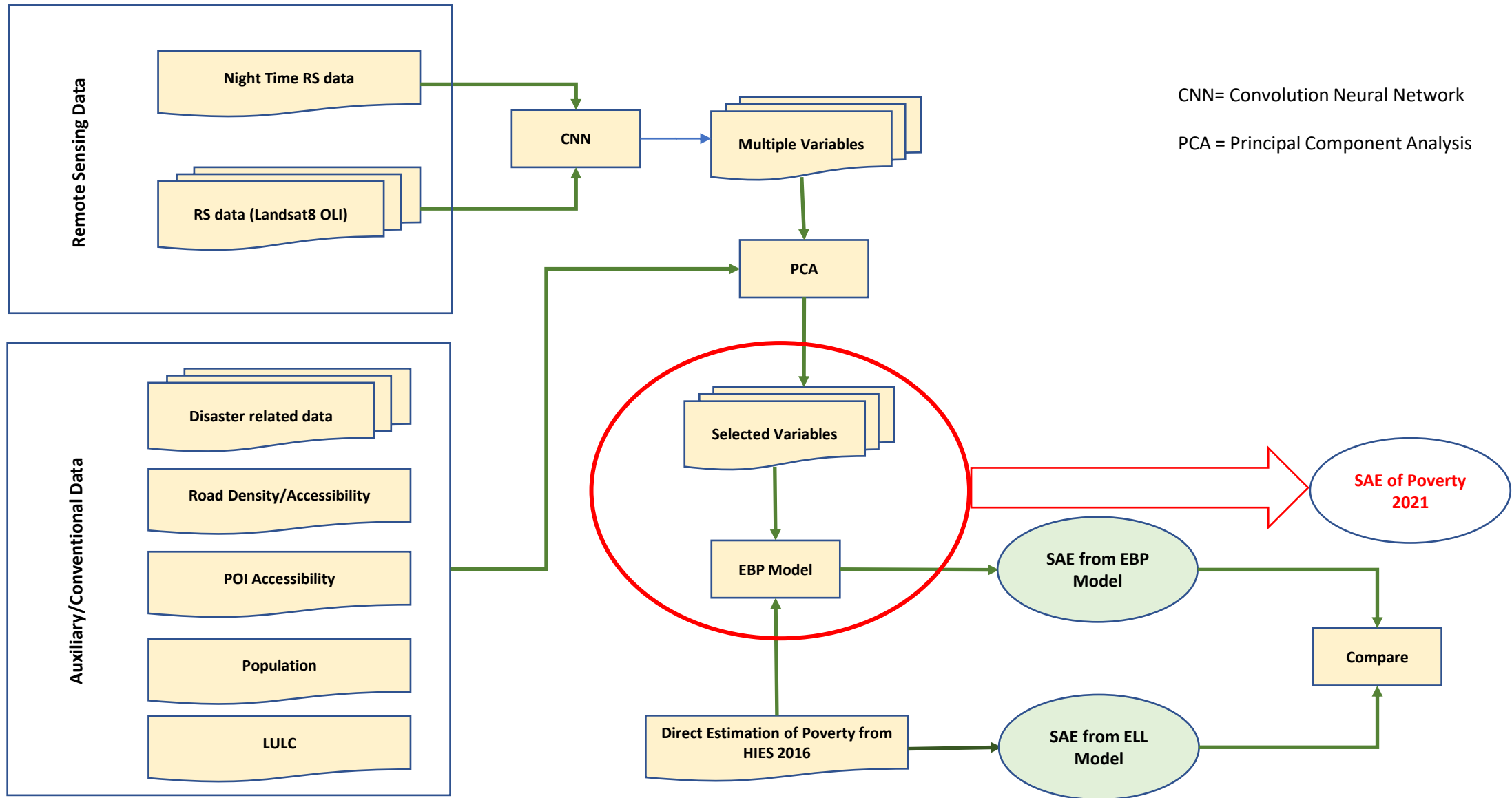
Files Plots Packages Help Viewer
Install Update
Name Description Versi...
User Library
[ ] aaos Another Object Orientation System 0.5.0
[ ] askpass Safe Password Entry for R, Git, and SSH 1.1
[ ] assertthat Easy Pre and Post Assertions 0.2.1
[ ] backports Reimplementations of Functions Introduced Since R-3.0.0 13.0
[ ] base64enc Tools for base64 encoding 0.1-3
[ ] BBmisc Miscellaneous Helper Functions for B. Bischl 1.11
[ ] bit Classes and Methods for Fast Memory-Efficient Boolean Selections 4.0.4
[ ] bit64 A S3 Class for Vectors of 64bit Integers 4.0.5
[ ] blob A Simple S3 Class for Representing Vectors of Binary Data (BLOBs) 1.2.2
[ ] hview Translation Framework for 1.0.6
```

# Future Data Requirement

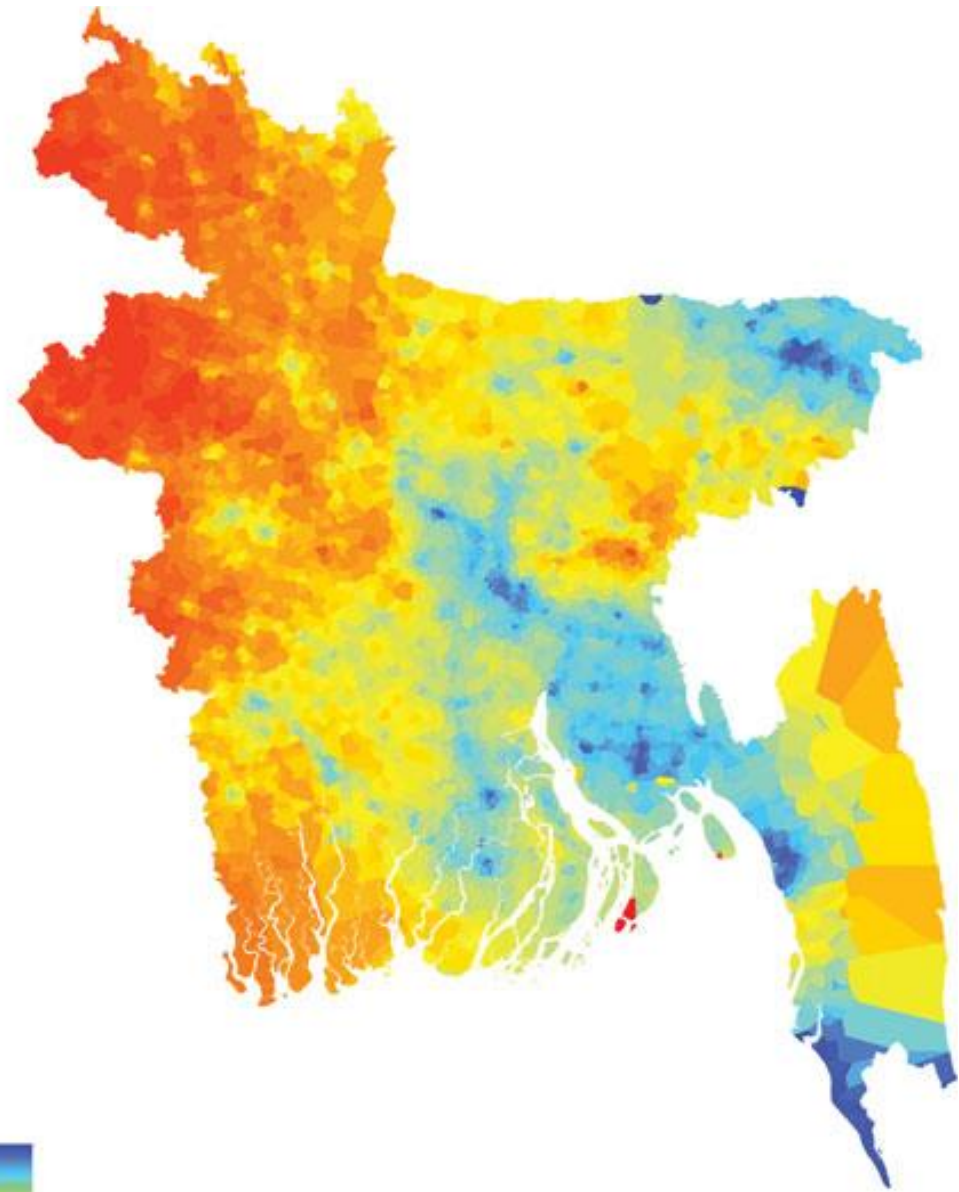
Description	Source	Level
Agent Banking	Bangladesh bank	Union Level
Mobile Subscriber	BTRC	Dist
Mobile movement	BTRC-telco	Upazila
Mobile Internet Uses	BTRC	Dist
Union Digital Center data	A2i	Dist
Crop Production	BBS	Dist
Crop Damage	BBS	Dist
Land Use and Land Consumption	Forest	Whole
Road Network	LGED, R&D	Line
Education facilities	Banbies, DPE	Point
Health Facilities	DPH	Point
Business Directory	BBS	Upazila
Crime Statistics	National Justice Audit	Upazila
Clean fuel and technology	MICS	District
Migrant worker	BMET	Upazila
Vaccination (polio, A cap)	DGHS, DPHE (EPI)	Upazila
Risk Inf	NRP-Prog Division	Upazila
Damage	DDM	Upazila
Weather	BMD	District
Tube well location	BADC, Barand	Upazila
POI	SoB	Point
Facebook wealth Index	Facebook	-
Disaster data	DDM	Upazila



# Proposed EBP Model for SAE of Poverty



# Expected Outcome



A white, irregular brushstroke graphic is centered on a black background. The brushstroke has a rough, hand-painted appearance with frayed edges. Inside the white shape, the words "Thank You" are written in a bold, green, sans-serif font. The background is filled with numerous thin, vertical lines in shades of blue and red, creating a digital or data-like texture.

**Thank You**