



**United
Nations**

**Twelfth Meeting of the Expert Group on
Environment and Climate Change**

Statistics (EG-ECCS)

(in-person and hybrid)

London, 23-25 September 2025

Wednesday, 24 September 2025

Climate change data collection support

**Use of alternative sources, big data and data science for
climate change statistics**

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Content

- Big data types
- Online survey results
- Methodologies
- Challenges and opportunities



BIG DATA

Big data, as defined by the UNSD (United Nations Statistics Division), refers to data sets that are too large and complex to be handled by traditional data processing tools within a reasonable timeframe.

It's characterized by its volume, velocity, and variety, often requiring specialized techniques and technologies to capture, store, manage, and analyze.



Definition: Big data refers to data that is high in volume, velocity, and variety, requiring advanced tools for processing and analysis.



Key Uses: Climate change, disasters, health, transport, economy, agriculture.

A satellite image of Earth at night, showing a curved horizon with a green aurora borealis in the upper left. The landmasses are illuminated by city lights, appearing as bright yellow and orange spots against the dark blue of the oceans and the black of space.

Satellite Imagery

- High-resolution images from space.
- Applications: Land cover, urbanization, deforestation, climate impact.



Remote Sensing from Drones

- UAVs (unmanned arial vehicles) equipped with cameras/sensors.
- Applications: Crop health, coastal changes, post-disaster mapping.

IoT Sensors



INTERNET-CONNECTED
DEVICES MONITORING
REAL-WORLD
CONDITIONS.



APPLICATIONS:
AIR/WATER QUALITY,
ENERGY USE, TRAFFIC,
WEATHER.

15 Types of Sensor in IOT



Temperature
sensor



Proximity
sensor



Pressure
sensor



Humidity
sensor



Electro-optical
sensor



Level
sensor



Image
sensor



Infrared
sensor



Gas
sensor



accelerometer
sensor



Water Quality
sensor



Smoke
sensor



Gyroscope
sensor



Optical
sensor



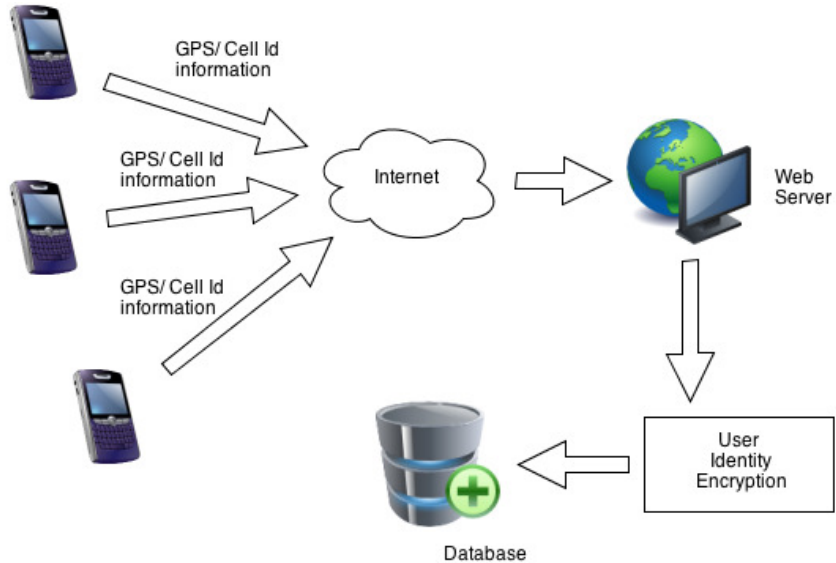
Hall effect
sensor

Mobile Phone Data



DATA FROM USER INTERACTIONS WITH MOBILE NETWORKS.

APPLICATIONS: MOBILITY PATTERNS, SERVICE ACCESS, DISASTER ALERTS.



THE ULTIMATE GUIDE TO Mobile Data Collection



Choosing an App



Designing Mobile Forms



Working Offline



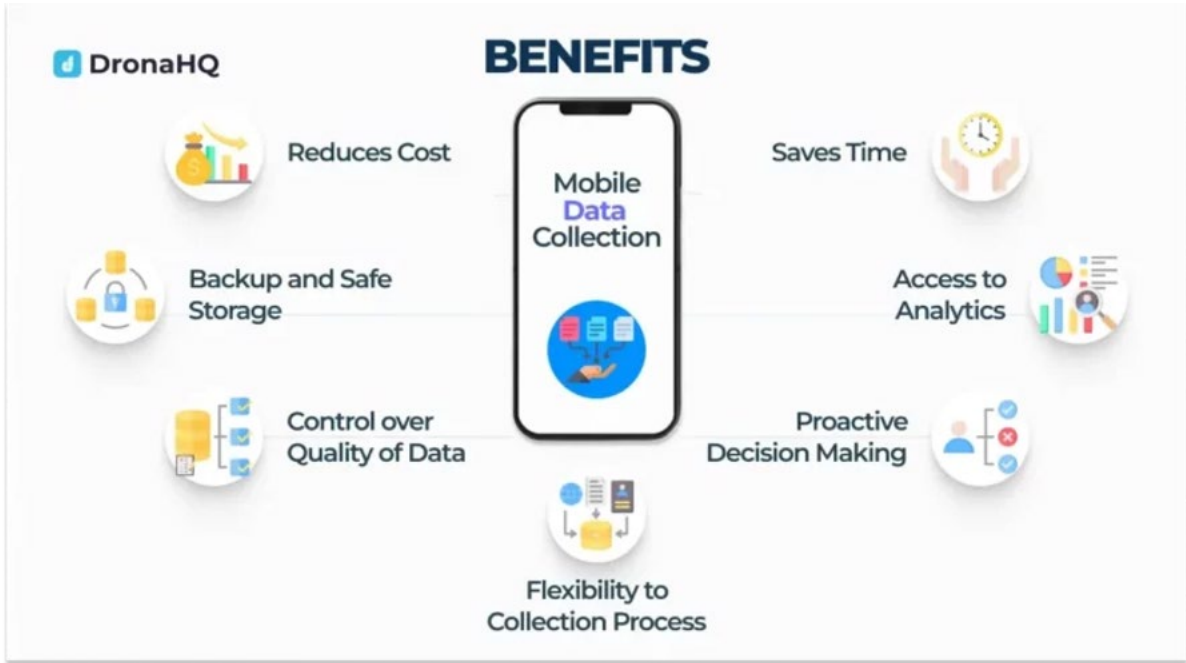
Data Security



Tracking Data Errors



Data Visualization

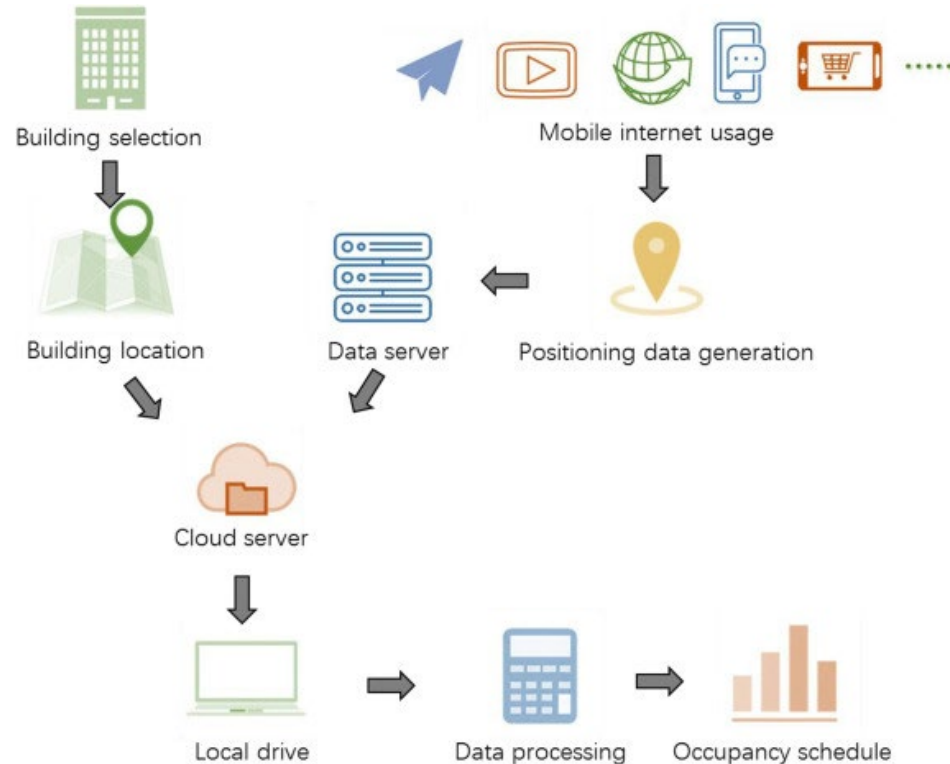


Mobile Positioning Data (MPD)



ANONYMIZED LOCATION DATA FROM MOBILE DEVICES.

APPLICATIONS: MIGRATION, TOURISM, EMERGENCY RESPONSE.



Social Media & Crowdsourced Data

User content from platforms or apps.

Applications: Event detection, sentiment analysis, early warnings.

Social Media Data – Information that comes from platforms like Facebook, Instagram, Twitter (X), TikTok, etc. It includes posts, comments, likes, shares, photos, and videos created by users.

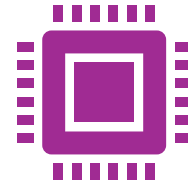
Crowdsourced Data – Information that is collected from a large number of people (the “crowd”), usually through apps, websites, or surveys. Everyone contributes small pieces of data, which together form useful information.

User-Generated Content (UGC) – Any text, photo, video, review, or other material created and shared by users themselves on platforms or apps, instead of by companies or professionals.

👉 Memory tip:

- **Social Media = people sharing online.**
- **Crowdsourced Data = people contributing information together.**

Smart Grid / Energy Data



Data from smart meters and power systems.



Applications: Energy usage, carbon emission estimation.



Smart meter = measures your electricity use at home.

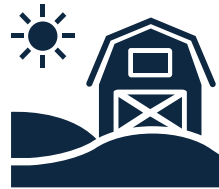


Power system data = shows how electricity is produced, moved, and used in the grid.

Agri/Forestry Equipment Sensors



Telemetry from machinery in fields or forests.



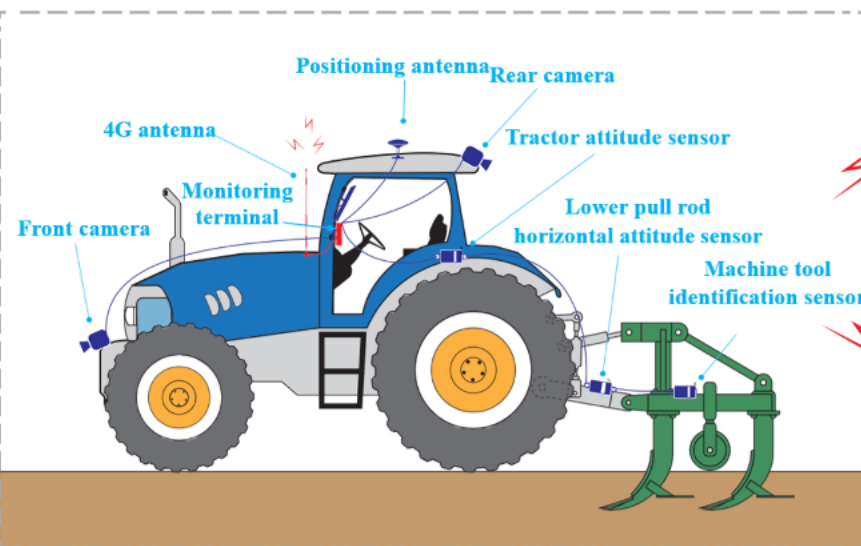
Applications: Land use, crop monitoring, biomass analysis.

All Products

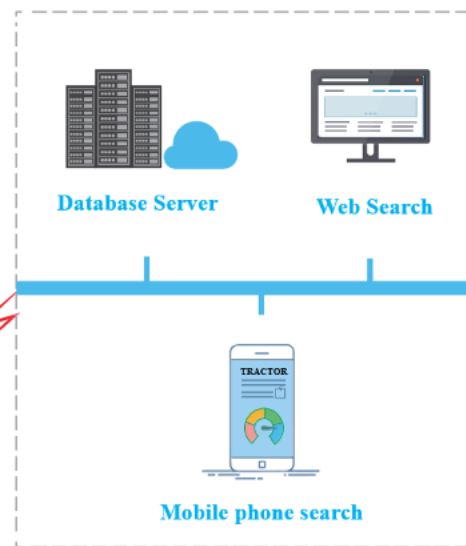
- Wind Transducer
- Air Velocity Transducer
- Air Temperature/Humidity / Digital Pressure sensor
- Solar Power Supply And Municipal Power Supply
- Rain Sensor
- Data Acquisition
- 5 in 1 Miniature Ultrasonic Weather Station
- 3 in 1 Soil Temperature Moisture&Electrical
- Soil Temperature Sensor
- Radiation Sensor
- Weather Display
- Software Interface
- PC Server Center

4G/5G/WIFI
RS232/RS485/GPRS

风速: 2.6m/s(二级)
风向: 134°(东南)
温度: 29.8℃
湿度: 82.0%
气压: 998.7hpa
辐射: 596.0w/m²

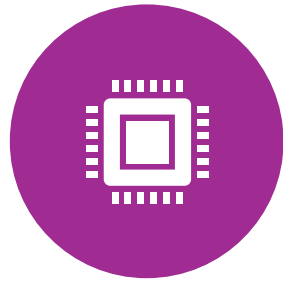


Online monitoring terminal for conservation tillage



Remote operation monitoring service system

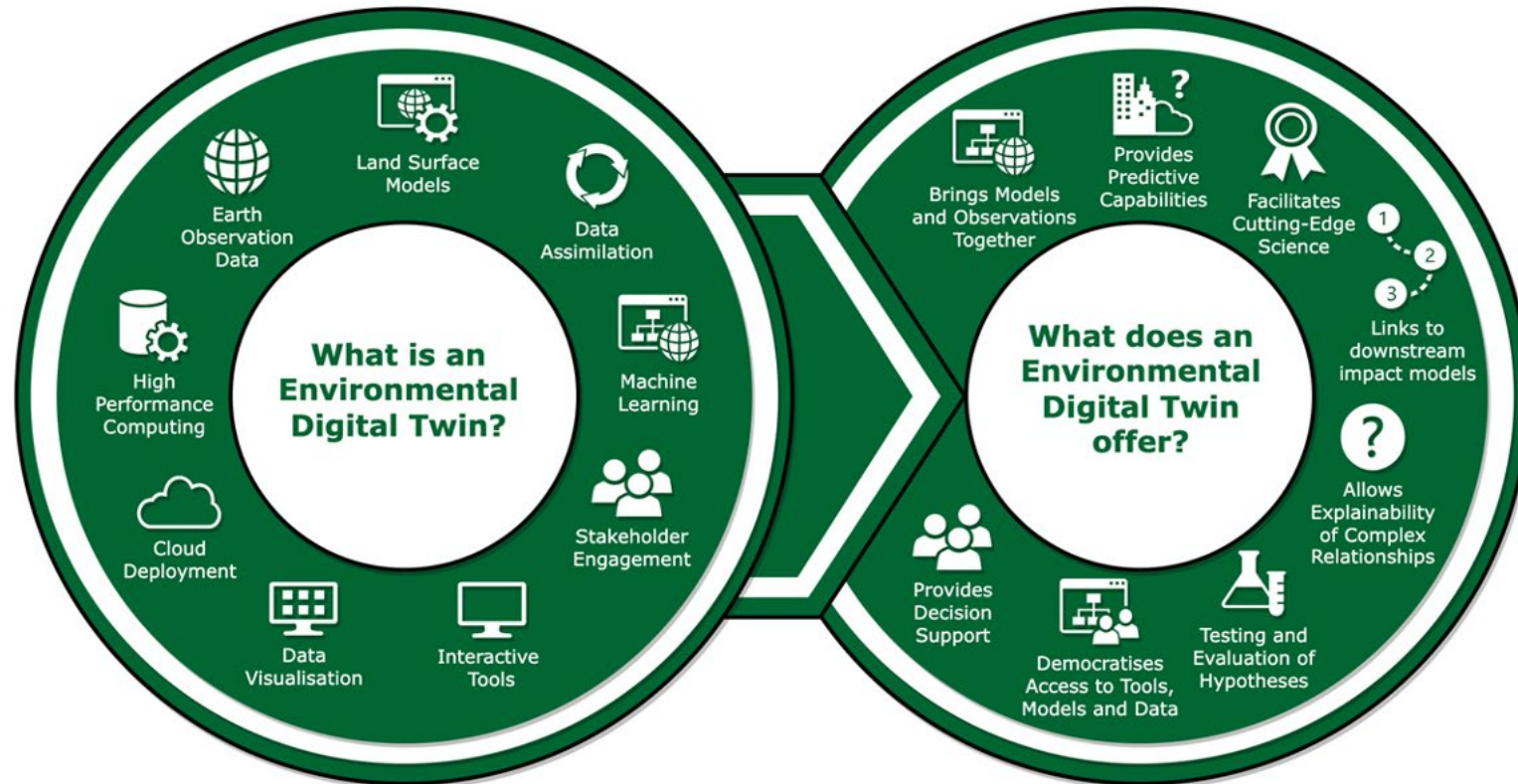
Digital Twins



REAL-TIME DIGITAL REPLICAS
OF PHYSICAL SYSTEMS.



APPLICATIONS: URBAN
PLANNING, INFRASTRUCTURE,
CLIMATE SIMULATION.



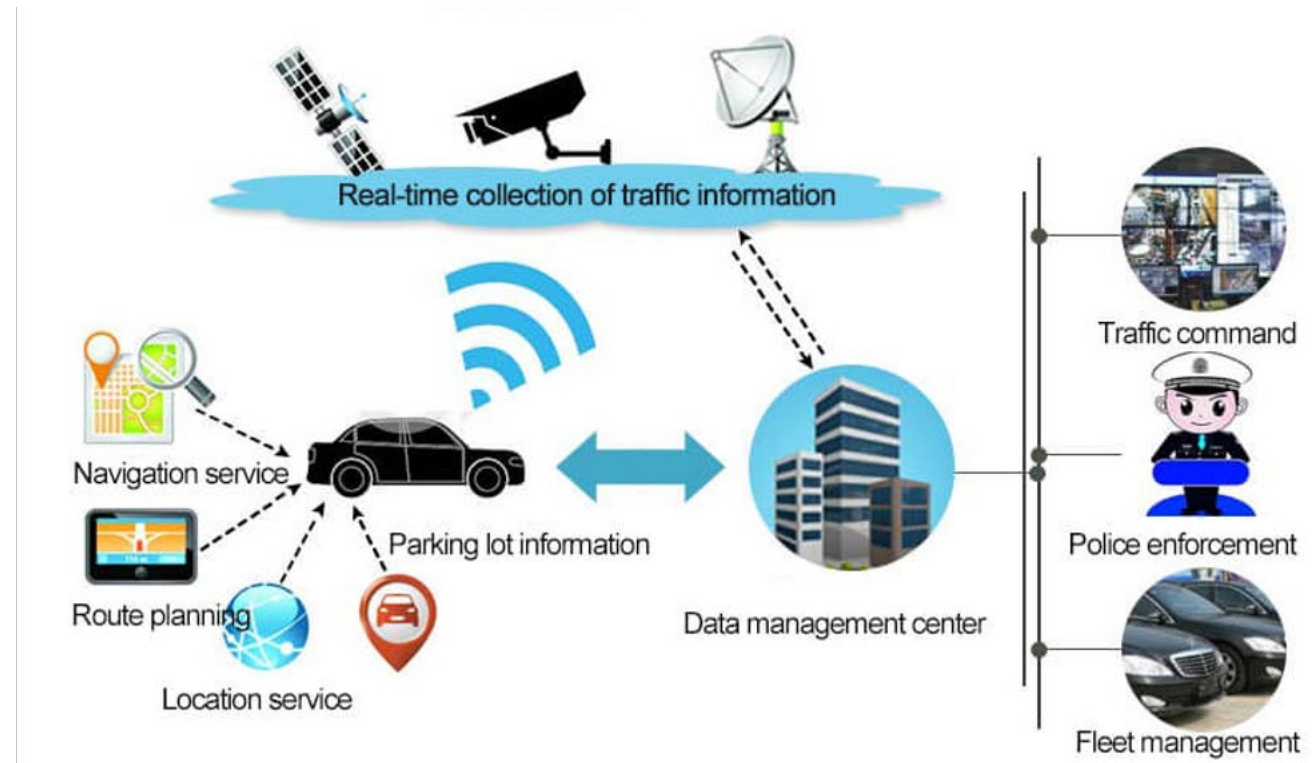
Road Sensor Data



SENSORS EMBEDDED IN
ROADS AND TRAFFIC
SYSTEMS.



APPLICATIONS: TRAFFIC
MANAGEMENT, EMISSIONS,
SMART CITIES.



Ships Identification Data (Automated Identification System - AIS)



Vessel data including ID, speed, route.



Applications: Maritime tracking, illegal fishing, emissions.

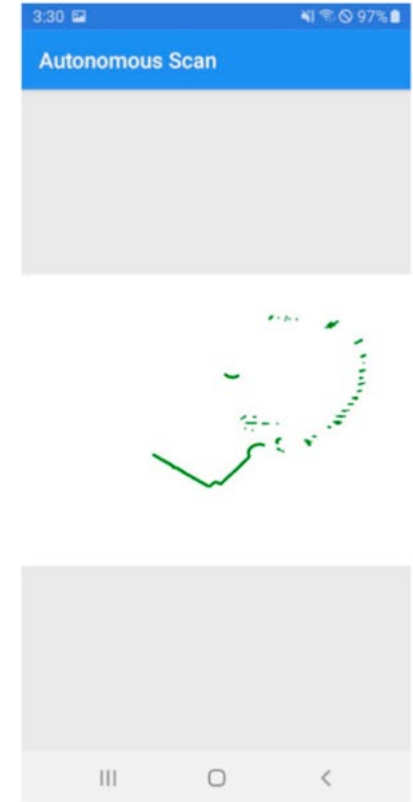
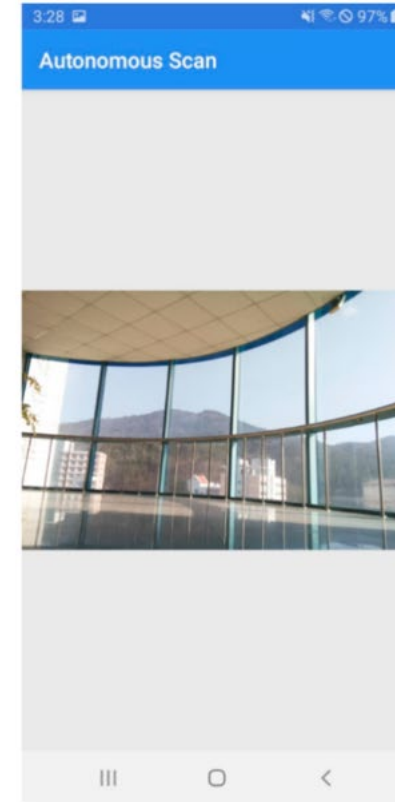
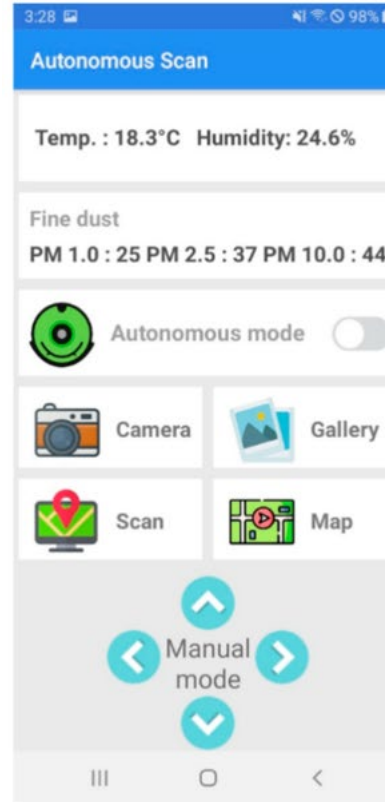
Scanner Data



RETAIL BARCODE
SCANS AT POINT-OF-
SALE.



APPLICATIONS: PRICE
INDICES, FOOD
SECURITY, MARKET
BEHAVIOR.



Web Scraping - Enterprise Info



Business data extracted from websites.



Applications: Company profiling, SDGs, economic analysis.



Web Scraping - Sentiment Indicators



ONLINE TEXT ANALYSIS USING NLP
(NATURAL LANGUAGE PROCESSING).



APPLICATIONS: PUBLIC OPINION,
POLICY RESPONSE, ECONOMIC
MOOD.

Application of big data from the online survey

Responding countries

1	Armenia	16	Indonesia
2	Brazil	17	Nepal
3	Cabo Verde	18	New Zealand
4	Cameroon	19	Norway
5	Canada	20	Palestine
6	Colombia	21	Peru
7	Dominican Republic	22	Poland
8	Germany	23	Republic of Korea
9	Ghana	24	Slovenia
10	Hungary	25	Spain
11	Ireland	26	Suriname
12	Japan	27	Switzerland
13	Jordan	28	Tunisia
14	Mauritius	29	UK
15	Mexico	30	United Arab Emirates

UN's Global Set of Climate Change Statistics and Indicators

A: Frameworks

- 1) Framework for the Development of Environment Statistics ([FDES 2013](#))
- 2) Global Set of Climate Change Statistics and Indicators
- 3) System of Environmental Economic Accounting Central Framework ([SEEA-CF](#))
- 4) System of Environmental Economic Accounting Ecosystem Accounting ([SEEA-EA](#))
- 5) Integrated Geospatial Information Framework ([UN-IGIF](#))
- 6) Global Statistical Geospatial Framework ([UN-GSGF](#))

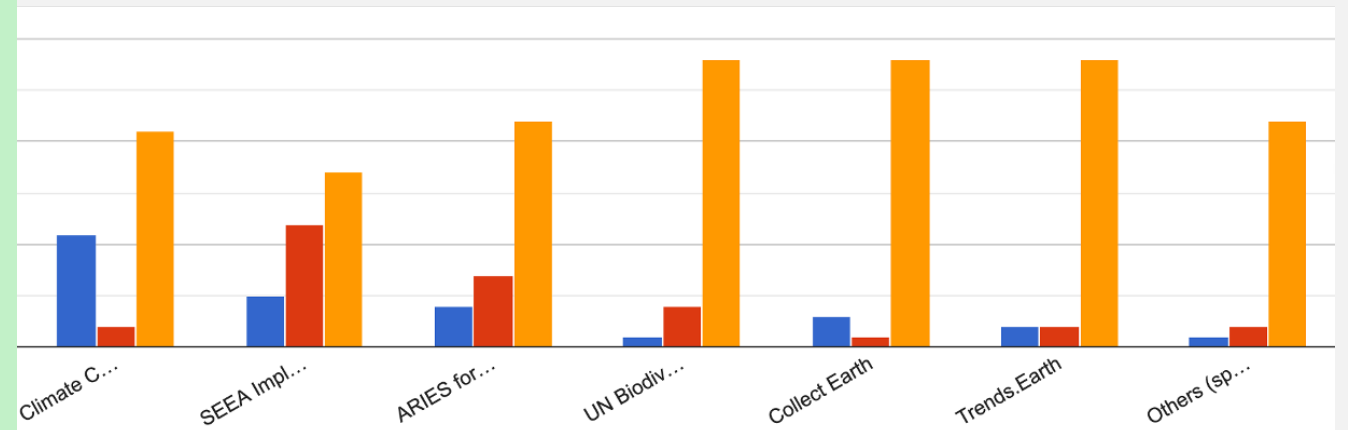
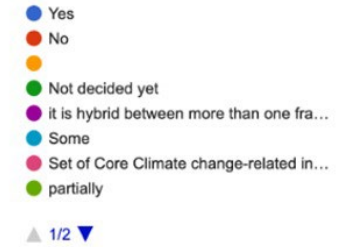
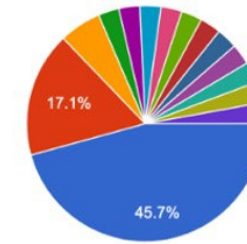
B. Tools and guidelines

- 1) Environment Statistics Self-Assessment Tool ([ESSAT](#))
- 2) Climate Change Statistics and Indicators Self-Assessment Tool ([CISAT](#))
- 3) [SEEA Implementation Guide](#)
- 4) [ARIES for SEEA](#)
- 5) [UN Biodiversity lab](#)
- 6) [Collect Earth](#)
- 7) [Trends.Earth](#)
- 8) Others (specify in the next question)

For the climate statistics, the 2) Global Set was most used, followed by 1) FDES, and the CISAT. Others were less used.

6. Does your institution compile climate change statistics/indicators as recommended by the UN Global Set of Climate Change Statistics and Indicators, and related frameworks?

35 responses

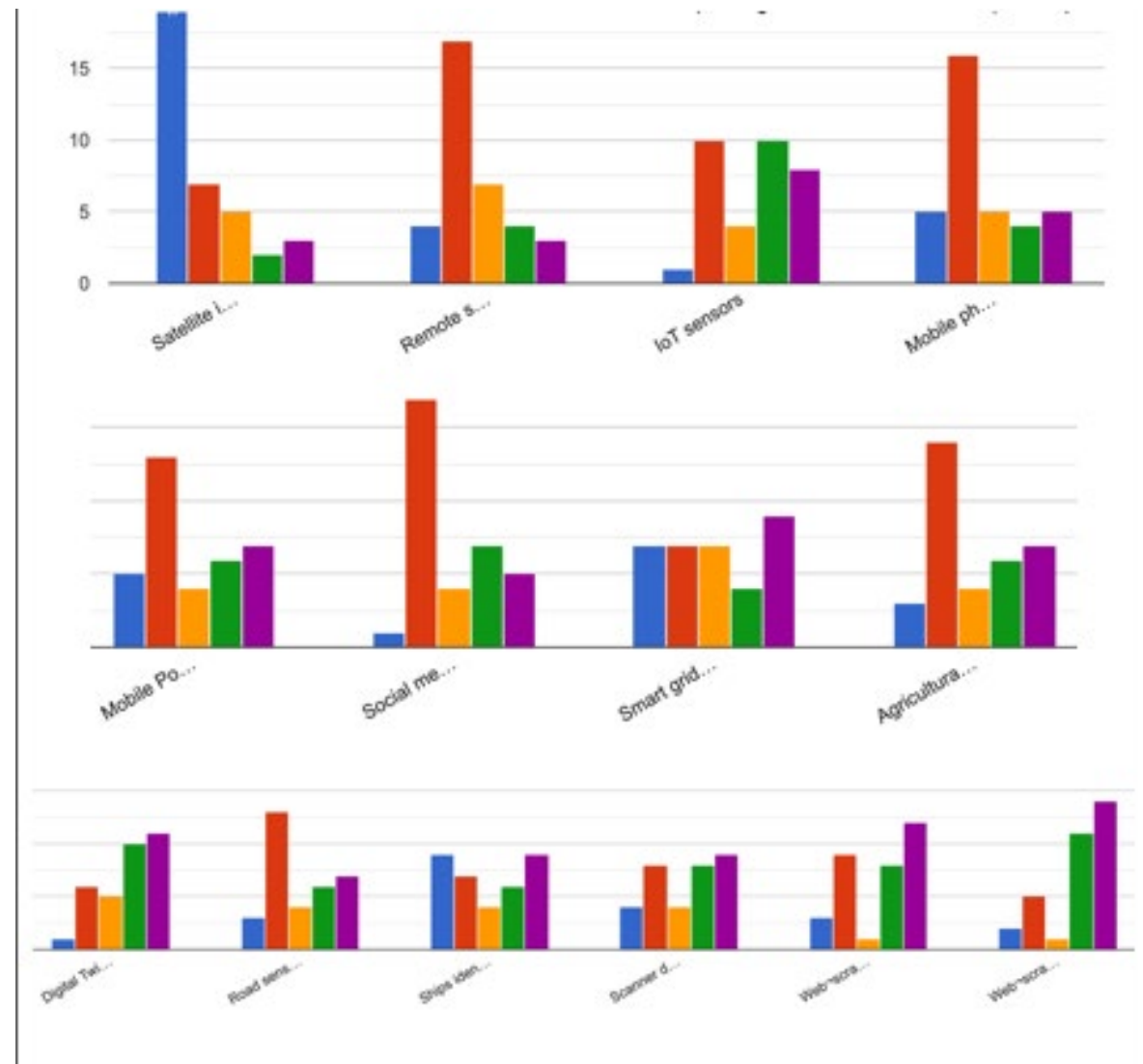


BIG DATA FOR OFFICIAL STATISTICS ON CLIMATE CHANGE

- **Awareness about the big data sources for climate change**

- 1) Satellite imagery
- 2) Remote sensing from drones
- 3) IoT sensors
- 4) Mobile phone data
- 5) Mobile Positioning Data (MPD e.g. for disasters, population, migration, transport)
- 6) Social media and crowdsourced data
- 7) Smart grid or energy consumption data
- 8) Agricultural and forestry equipment sensors
- 9) Digital Twins for modelling/simulations with equipment sensors
- 10) Road sensor data
- 11) Ships identification data
- 12) Scanner data
- 13) Web-scraping data - Enterprise information
- 14) Web-scraping data - Sentiment indicators

Awareness was mainly focused on satellite data, mobile phone data, smart grids, and ship identification systems.



A few methodological notes

Big Data Type	Uses for UN Global Set	Guidelines for Data Collection & Processing	Tools / Software for Processing & Output
Satellite & Remote Sensing Data	Monitoring climate impacts (temperature, sea level, ecosystems), land cover, disaster risks, adaptation planning	Ensure spatial/temporal resolution fits objectives; validate with ground-truth data; pre-process (cloud masking, calibration); document metadata	Google Earth Engine, QGIS, ArcGIS, SNAP, ENVI, Python (rasterio, GDAL)
Agricultural & Forestry Equipment Sensors	Adaptation (climate-resilient agriculture), mitigation (optimized fuel use, forest management), vulnerability assessments	Regular calibration; secure data transmission; anonymize and aggregate; maintain consistent logging formats	Python (pandas, NumPy), R, Tableau, Power BI, MQTT platforms
Digital Twins & Simulation Models	Modelling impacts, testing mitigation/adaptation scenarios, analysing drivers/vulnerabilities	Validate model inputs; document assumptions; maintain version control; ensure reproducibility	AnyLogic, MATLAB/Simulink, Python (SciPy, PyDSTool), Unity for 3D visualization

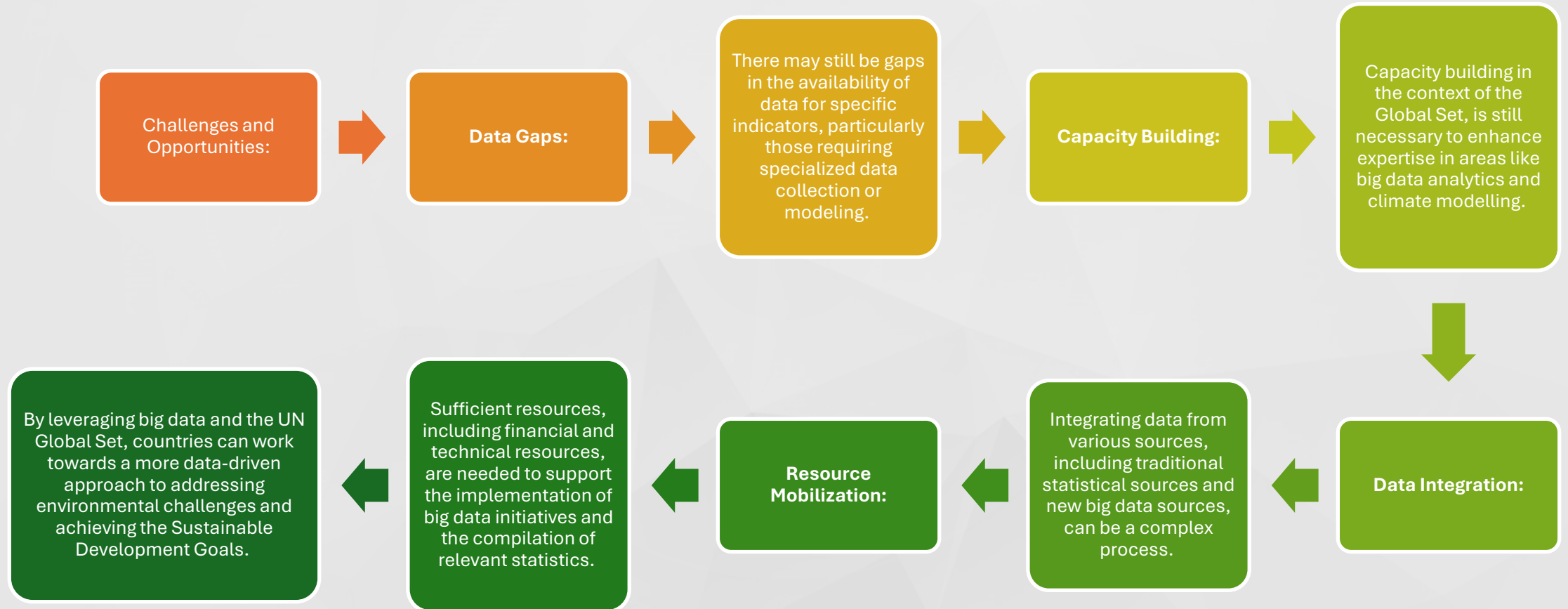
A few methodological notes

Big Data Type	Uses for UN Global Set	Guidelines for Data Collection & Processing	Tools / Software for Processing & Output
Road Sensor Data	Drivers (emissions), impacts (air quality, ecosystems), mitigation (traffic optimization), adaptation & vulnerability	Standardize calibration; anonymize vehicle data; implement consistent time-stamping; regular maintenance	Python (pandas, matplotlib), R, Tableau, QGIS, ArcGIS, SQL databases
Ships Identification Data	Drivers (shipping emissions), impacts (marine ecosystems), mitigation (fuel optimization), adaptation (resilient ports), vulnerability	Use standardized AIS systems; validate with port records; anonymize sensitive info; ensure temporal consistency	Python (pandas, geopandas), R, Marine Traffic APIs, QGIS, SQL databases
Scanner Data	Drivers (energy/transport/agriculture), impacts, mitigation, adaptation, vulnerability	Use consistent categorization; secure storage; aggregate to protect privacy; update datasets regularly	Python (pandas), R, Excel, Power BI, Tableau

A few methodological notes

Big Data Type	Uses for UN Global Set	Guidelines for Data Collection & Processing	Tools / Software for Processing & Output
Web-Scraping Data (Enterprise Info)	Drivers, impacts, mitigation, adaptation, vulnerability	Comply with website terms; anonymize; validate; implement automated cleaning	Python (Beautiful Soup, Scrapy, pandas), R (rvest), Excel, SQL databases
Web-Scraping Data (Sentiment Indicators)	Drivers, impacts, mitigation, adaptation, vulnerability	Collect from reliable sources; text cleaning; use sentiment tools; document methodology	Python (NLTK, TextBlob, Vader, spaCy), R (tidytext), Tableau, Power BI
Web-Scraping Data (Enterprise Info)	Drivers, impacts, mitigation, adaptation, vulnerability	Comply with website terms; anonymize; validate; implement automated cleaning	Python (Beautiful Soup, Scrapy, pandas), R (rvest), Excel, SQL databases

Challenges and opportunities



load of thanks

THANK YOU FOR YOUR KIND ATTENTION

