How to collect the data needed?
Introduction to main data sources developing efficiency indicators

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IEA #energyefficientworld

- Overview of main methodologies for collecting energy efficiency data

- Construct validity / External validity (CM)

- The role of new technologies in data collection

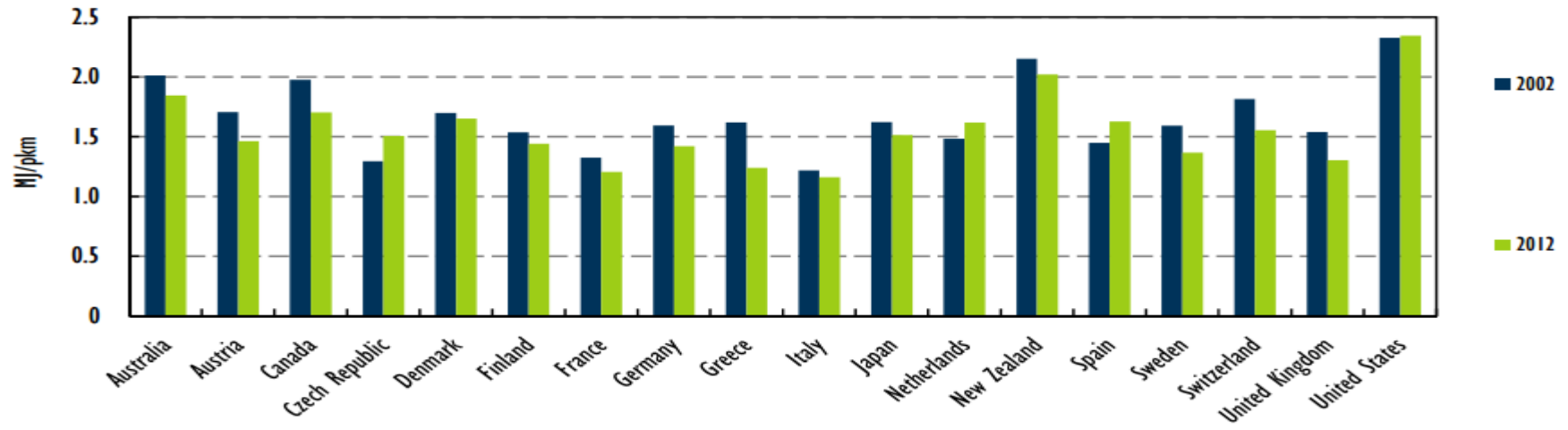- Experience across the region (ADB, UNESCAP)

Example of efficiency indicators: industry and services

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Residential space heating (GJ/m²)
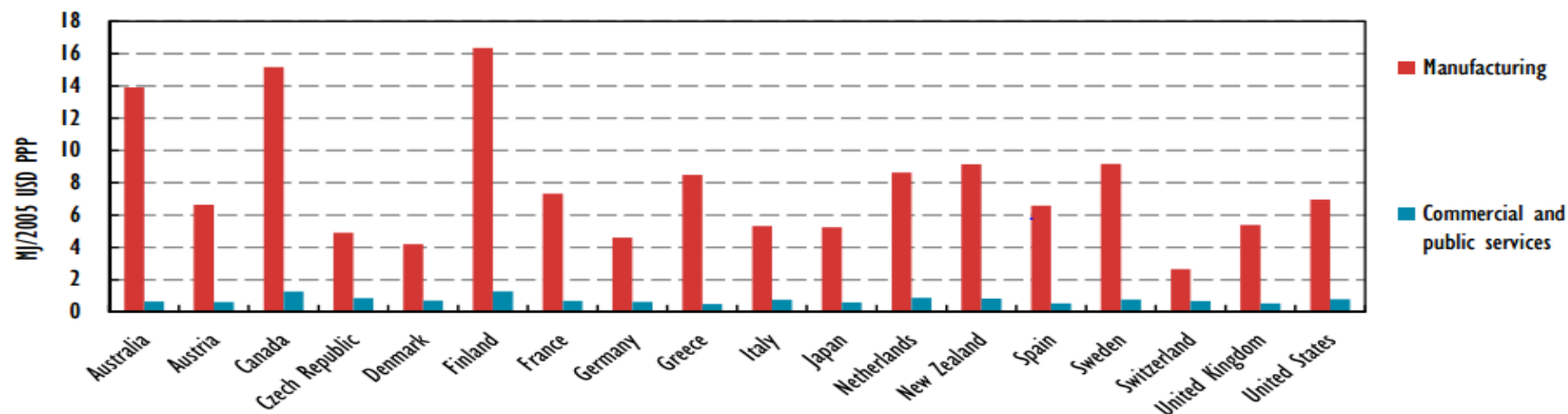
Example of efficiency indicators: buildings
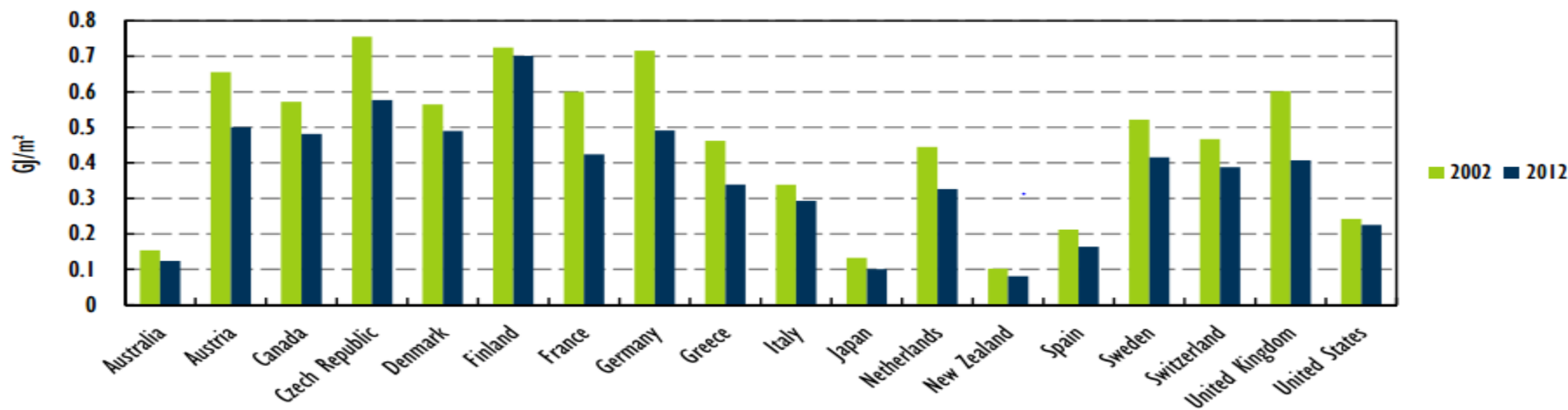
Example of efficiency indicators: transport

Collecting energy efficiency data

- **Two general principles:**
  - Collect what is needed – focus on **priorities**

  - Research already **existing** sources (e.g. transport ministry)

Methods used by countries to collect data for indicators

➤ Administrative sources
- before starting new data collection

➤ Surveys
- representative sample
- possibly expanding existing surveys

➤ Metering and measuring
- costly but very effective for monitoring specific equipment efficiency

➤ Modelling
- complementary to surveys or stand alone

How to collect the data?

- Administrative sources: **data-sharing across organizations**, identifying data gaps

- Surveying: often **stratified samples** (cost, time, accuracy, detail)

- Measuring: identifying **specific energy-uses** (e.g. energy audits, smart meters)

- Modelling: integral parts of data collections to estimate energy use processes
  - It is recommended to combine with cost-effective data collection schemes to build complete set of indicators which can be provided in a timely and stable manner.

Schematics of a transport model: source, output and validation

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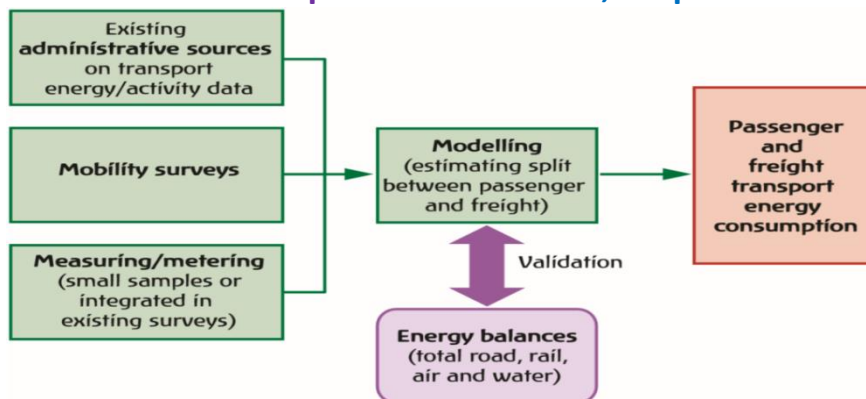
How to check the data?

- **Coverage:** sub-sector boundary (UN ISIC), annual time-span, net calorific value

- **Internal consistency:** data coherence and summation, revision of historical data (changes in definition, sources, classifications, methodologies, etc.)

- **External sources consistency**: figures in national statistics or energy balances, publications from related authorities

- **Plausibility:** zero vs not-available, reasonability within expected range of values
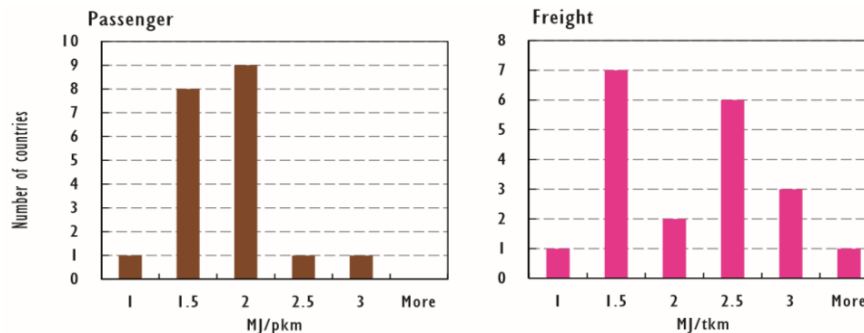
Reported range of transport EEI (OECD 20)

Examples of data and sources for the residential sector

Table 4.2 ● *Summary of the main data needed for residential indicators and examples of possible sources and methodologies*

Data	Source	Methodology
Energy data		
Total residential consumption	National energy balance	Administrative sources Modelling
Energy consumption by source	National energy balance Utilities	Administrative sources Modelling
Activity data		
Floor area	National statistics offices Real estate Regional governments Taxation registers	Administrative sources Surveys
Number of dwellings	Land registry National statistics offices	Administrative sources Surveys
Heating equipment	Building registers Manufacturers/Vendors Subsidy registers	Administrative sources
Number of appliances	Manufacturers National statistics offices	Administrative sources Surveys

IEA Energy Efficiency Indicators: Fundamentals on Statistics, 2014

Administrative sources: using existing data that fits your purposes

Pros	Cons
Typically **less expensive** than a new data collection process	**Boundary issues**: potential mismatch between existing and needed data
Relatively **quick availability**	Challenges in establishing and keeping **institutional communication**
Increased synergy between institutions	Possible **costs** (e.g. purchase data, change data formats...)
Raise profile of **energy efficiency** among different services	**Time investment** in research to find the right sources

The importance of establishing a framework

Surveying: collecting ad-hoc data from a representative sample

Pros	Cons
Relatively cost-effective, given extensive information collected	Potentially **high absolute cost**
Ad-hoc **design of items** collected based on purpose	**Time** consuming and requires **trained staff**
Representativeness / statistical significance	**Need for further estimation** (e.g. extrapolation between years)
Usually comprehensive and **good quality data**	**Risk of incomplete** responses, **biases**, sampling errors

Leveraging on national statistical capacity (NSO) and existing surveys

IEA database on country practices for data collection

- ➢ Practices in surveying, administrative sources, modelling and metering across sectors

- ➢ Questionnaires and other material available

- ➢ Links to various national administrations work

Energy Efficiency Indicators Statistics: Country Practices Database

7 results found
(Tip: sort columns by clicking on the column header)
Perform another search

Filter: [   ]

Practice	Countries and territories	Sector	Methodology	Available content
R/Ad/08	Indonesia	Residential	Administrative sources	
R/Su/15	Indonesia	Residential	Surveying	questionnaire
R/Su/22	Thailand	Residential	Surveying	
R/Mo/09	Indonesia	Residential	Modelling	
I/Su/13	Indonesia	Industry	Surveying	
I/Su/24	Thailand	Industry	Surveying	
R/Su/33	Philippines	Residential	Surveying	questionnaire

An example of how to benefit from each other's work
http://www.iea.org/eeindicatorsmanual/

Philippines: household survey example

Background	
Country	Philippines
Sector	Residential
Methodology	Surveying
Organisation	Department of Energy / Philippine Statistics Authority (formerly National Statistics Office)
Name	2011 Household Energy Consumption Survey (HECS)
Purpose	The primary goal of HECS is to generate comprehensive and reliable data/information and analy consumption in the residential sector of the country which is essential in formulating and impler programs that aim to improve the quality of life of the Filipinos, in accordance with the governm particularly expanding energy access and strengthening consumer and welfare protection.
Data collection purpose	The specific objectives are as follows: Provide detailed information on the changing energy consumption patterns in Filipino househol conditions affecting energy use; Establish the fuel/energy mix of the residential sector based on its energy consumption; Determine the most energy consuming appliances, devices and equipment used for household a Assess the current energy efficiency and conservation techniques in the residential sector vis-a-v implementation of energy consumption regulation for household appliances and equipment; Measure and analyze the incidence of inter-fuel substitution in the households; and Determine awareness and/or perception of the household on major energy issues (i.e. nuclear e labelling program, renewable energy, natural gas) in the energy sector.

Data collection	
Sample design	Multi stage sampling design using the 2003 Master Sample (MS) developed by the Philippine Stat

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HECS FORM 1
NSCB Approval No.: NSO-1114-01
Expires: December 31, 2012

CONFIDENTIALITY
This survey is authorized by Commonwealth Act 591.
All information obtained will be strictly held confidential.

Republic of the Philippines

NATIONAL STATISTICS OFFICE and DEPARTMENT OF ENERGY

2011 HOUSEHOLD ENERGY CONSUMPTION SURVEY

Booklet ___ of ____ booklet

PART I - A. GEOGRAPHIC IDENTIFICATION AND OTHER INFORMATION

GEOGRAPHIC IDENTIFICATION CODES

Province _____
Mun/City _____
Barangay _____
EA ....
SHSN ....
HCN ....
Number of Households in the Housing Unit _____

INTERVIEW RECORD

Visit Indicator	1	2	3
Date of Visit			
Time Began			
Time Ended			
Result Code*			

FINAL RESULT CODE* _____

***RESULT CODES**
01 - Completed Interview
02 - Refusal
03 - No household member at home or
      No competent respondent at home at time of visit
04 - Entire household absent for extended period of time
05 - Vacant housing unit
06 - Housing unit destroyed
07 - Address not a housing unit
08 - Housing unit not found
09 - Critical or flooded area
10 - Others (specify) _____

Name of Respondent _____

Sex _____   1 Male   2 Female

Relationship to the Household Head _____

Address _____

CERTIFICATION

I hereby certify that the data gathered in this questionnaire were obtained/reviewed by the undersigned personally an in accordance with instructions.

Signature over Printed Name of Enumerator	Date Accomplished	Signature over Printed Name of Supervisor	Date Reviewed

Construct Validity

- Consider whether indicators are a good representation of the outcome of interest

- https://www.youtube.com/watch?v=PTpQYDTgq7E

- Average consumption might not represent real consumption e.g.
  - Heavy users might be more likely to buy efficient products
  - Annual consumption may not be a good indicator of peak demand

- Number of products sold might not be a good indicator for energy savings…often assumes:
  - Inefficient products retired at end of useful life
  - Operated for the same hours as inefficient product
  - Maintained properly

- Some sectors of interest may behave differently from the average e.g. rural consumers, poor households, women

External validity

- Can we generalise from a sample to the population as a whole?

- Consider:
  - Sample size
  - How data were collected
  - Systematic biases e.g.
    - House to house survey excluded people who are out during data collection
    - Views/behavior of women/minorities might be under-represented
    - Online surveys exclude people without internet access (older, poorer, more rural)
  - Extrapolation method:
    - Basis for extrapolation (e.g. number of households or number of people)
    - Were different weights applied to groups with different behaviour
    - Reliability of population data

The role of new technologies in data collection

Gamification of surveys

- *As a potential benefit, gamification provides motivational affordances that produce psychological (e.g., user experience, emotion, fun) and behavioral (e.g., participation, performance) outcomes*

Source: Harms et al (2015) Gamification of Online Surveys: Design Process, Case Study, and Evaluation
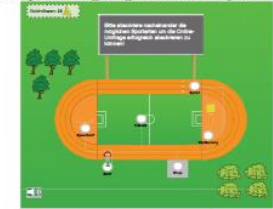

a) Avatar creation

b) Map for navigating between survey areas

c) Soccer game for single choice questions

d) Javelin throwing for Likert questions

e) Long jump for Likert questions

f) Sprint for free-text questions

g) Shop to spend rewarded coins

h) Medal ceremony as a thank-you page

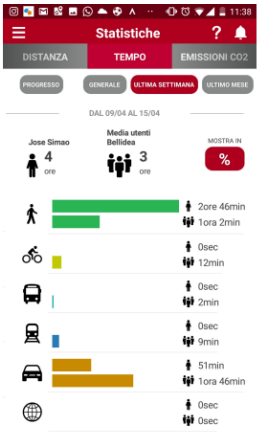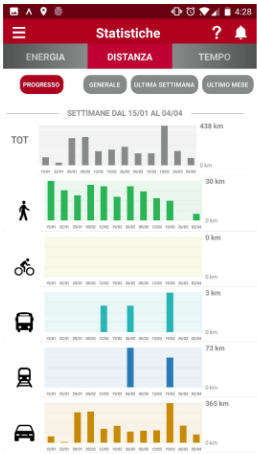# New technologies and digitalization open a world of *big data*
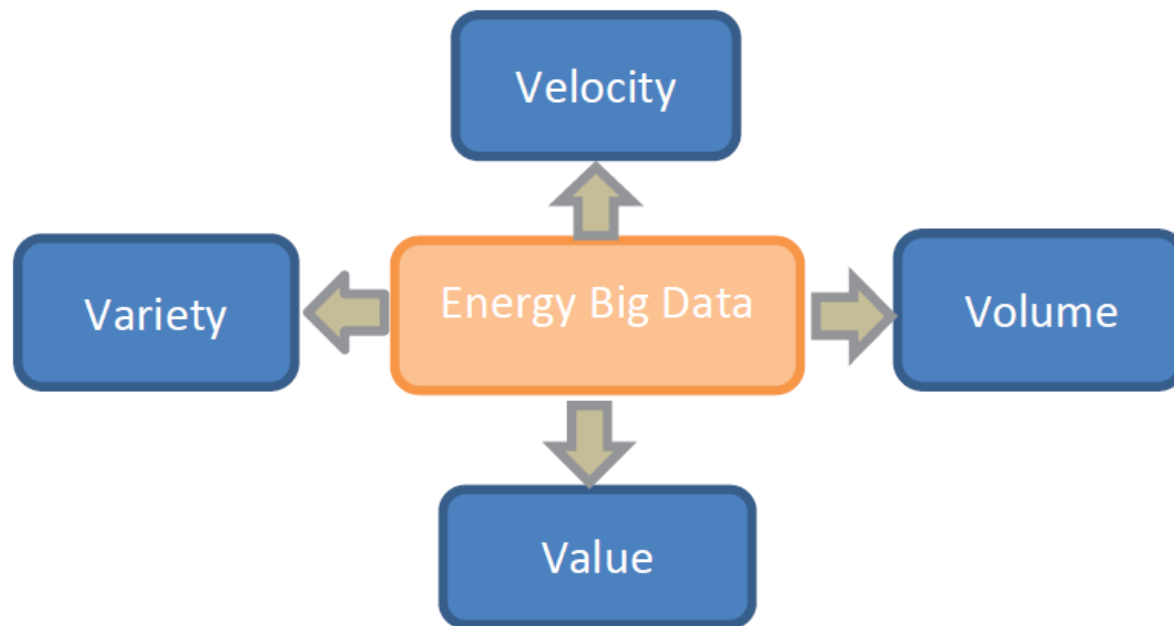
Source: Koseleva and Ropaite (2017) Big data in building energy efficiency

The advantages of big data

Examples of applications for the residential sector

# Examples of applications for the transport sector

From left to right: weekly evolution of kilometers travelled; weekly share of transport modes and comparison with average Bellidea users; weekly evolution of points.
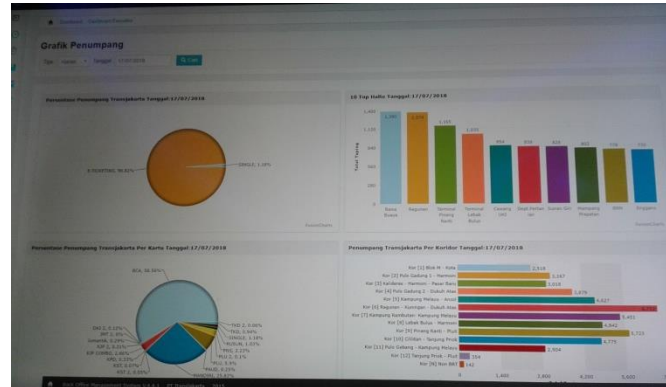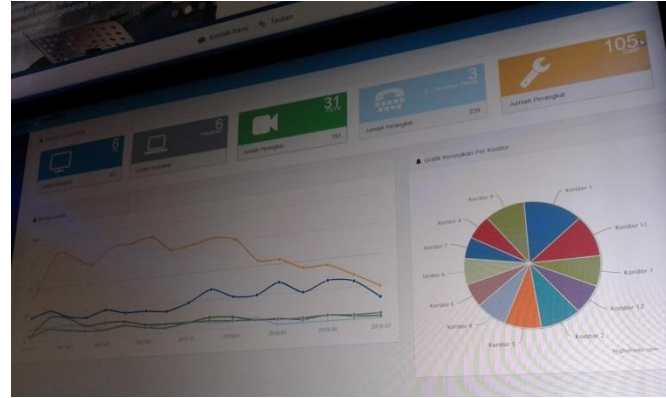
Source: Cellina et al (2018) Outcomes of a smart city living lab prompting low-carbon mobility patterns by a mobile app

Source: SmartComm Electronics Pte Ltd

Source: https://www.autoroutes.fr/en/webcams.htm
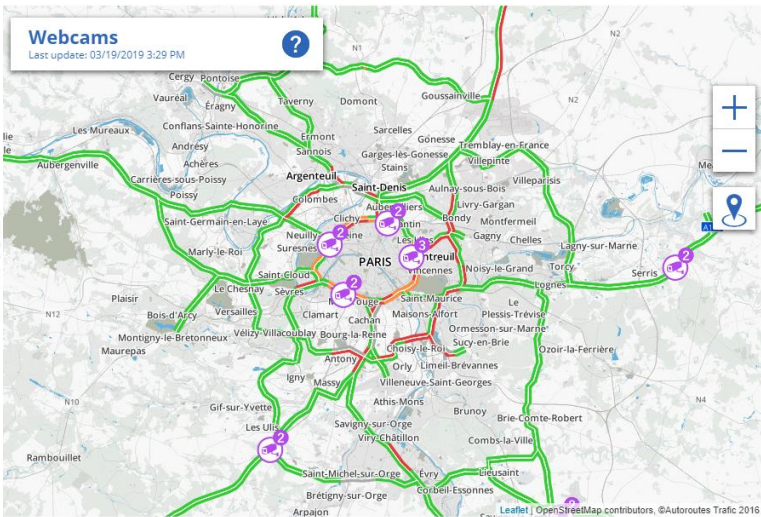
Bus Rapid Transit system of Jakarta

Few questions still open

- Data ownership

- Confidentiality issues

- Security issues

- Data standardization and treatment : easier to get in than out

- Best methodologies to process the data?

What is your experience?

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