Sensor-based Air Quality Monitoring
Opportunities, Impacts and Challenges

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27th March 2019

Sensors, What Are They?

Metal oxide
~ 10 USD
~ since 1960s

Electrochemical
/ voltammetric
~ 10 USD
~ since 1980's

Photochemical
200 ~ 300 USD
~ since 1990's

Micro-optical
> 150 USD
~ since 2000's

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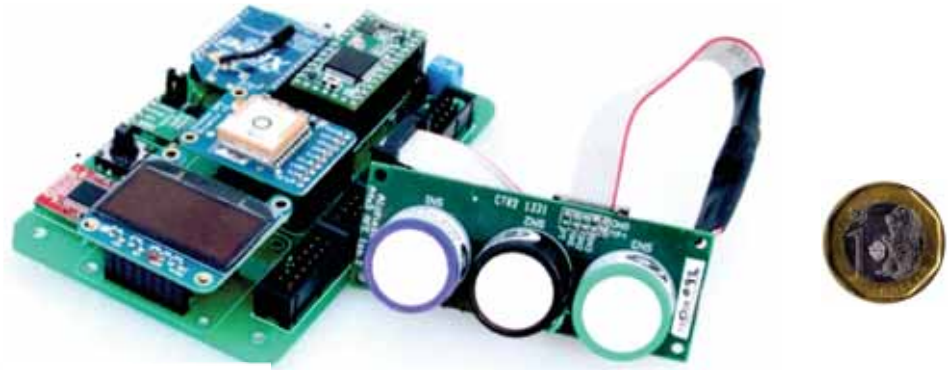
Sensors for Air Quality Monitoring



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Democratisation of Air Quality

DEMAND
anytime,
anywhere

INEQUALITY
budget, skills

COST
owning, operating

Vision

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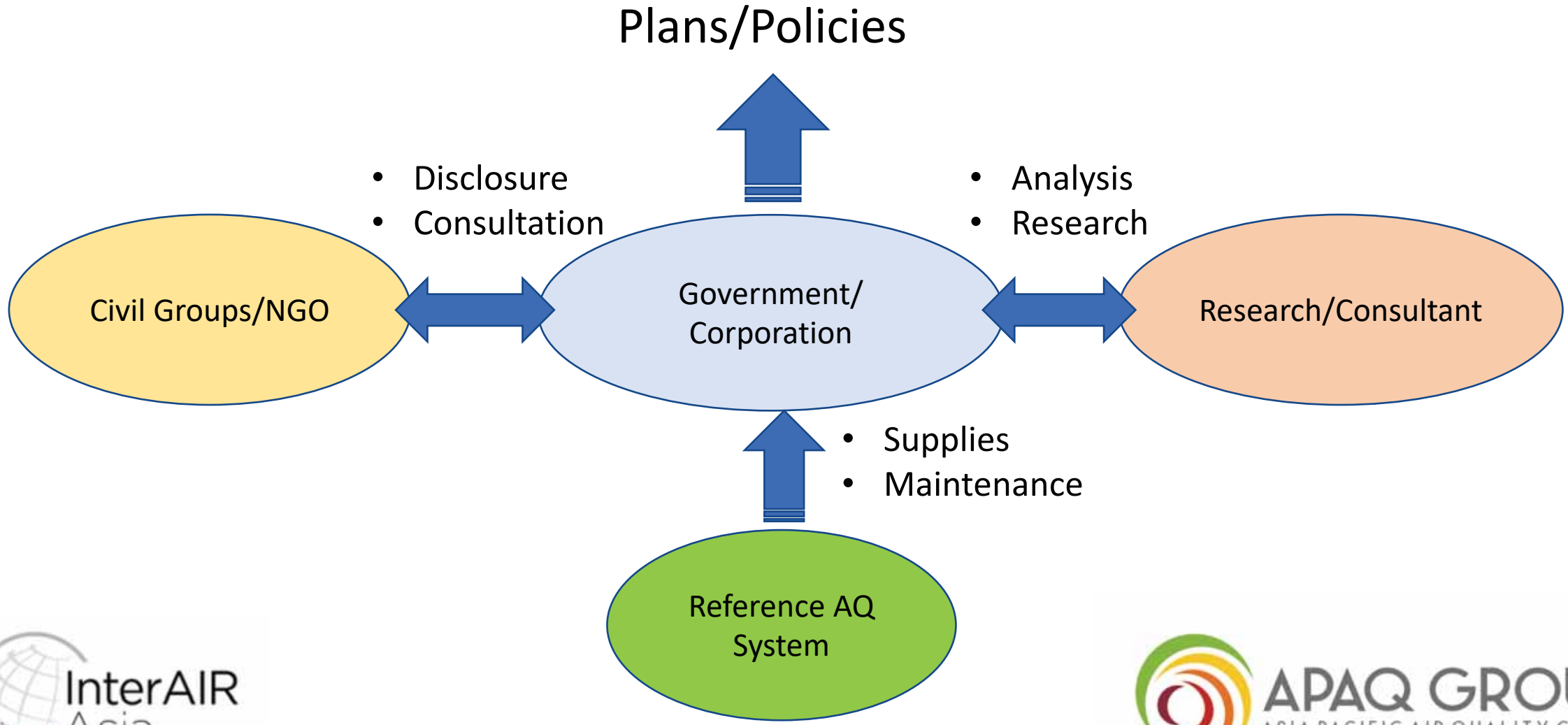
Air Quality Management Framework



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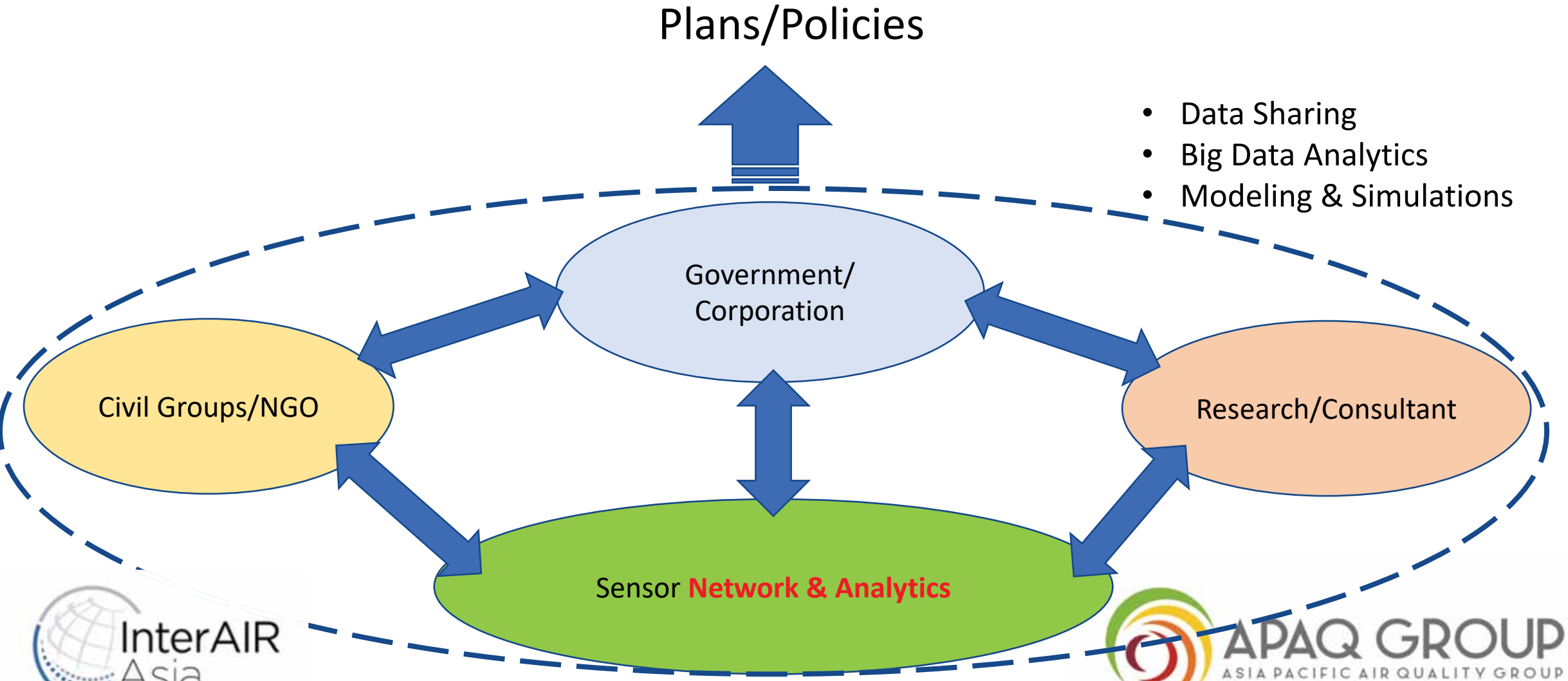
Impacts of AQ Sensor Network



- Data Sharing
- Big Data Analytics
- Modeling & Simulations

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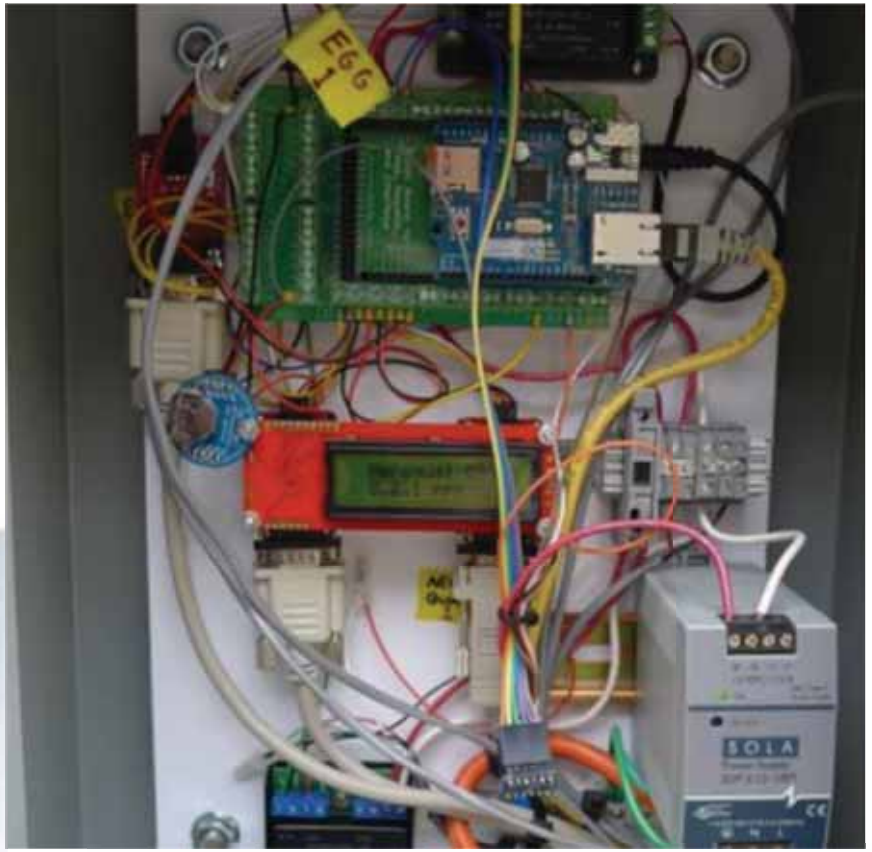
State of Commercialisation



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Challenges for Developers

- Lack of consistency
- Systematic bias
- Cross-sensitivity
- **“No talk on sensor is complete without the words – Machine Learning” – UK DEFRA**

Sensor	Compound					Co-pollutants		
	CO	SO_2	NO	O_3	NO_2	CO_2	H_2	%RH [a]
CO - B4	0.378	-0.013	0.000	0.0200	0.032	0.000	-0.032	0.201
OX-B421	0.000	-0.016	-0.110	0.439	0.44	9.5×10^{-5}		0.560
SO_2-B4	0.013	0.210	0.023	-0.014	-0.32	9.8×10^{-6}		0.000
NO-B4	0	0.007	0.558	-0.011	-0.590	1.8×10^{-5}		-0.303
NO_2-B4	0	0.004	-0.008	0	0.148	2.3×10^{-5}		0.000

Sensitivity to other air pollutants (interferences)

Challenges for Users/Regulators

- A wide range of performance;
- Data handling was discussed in minority sources.
- Harmonisation of performance is needed.
- Authorities to guide application and criteria.

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Application-based Approval

- **Smoke monitoring** **for** **wildland fire** AQ response

- **Dust monitor** for control of **earth-moving activities**

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New Paradigm?

Regulator

To Approve/Reject → To Encourage/Guide

Corporations

AQ in the Cost Centre → AQ in the Value Chain

AQ Specialists

Compete by Low Cost → Differentiate by Functions & Analytics

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Application Opportunities

Heavy Industries

Light Industry, Construction

AQ Sensor Market

Commercial

Civic Facilities

Private Space

Regulator (EPA)

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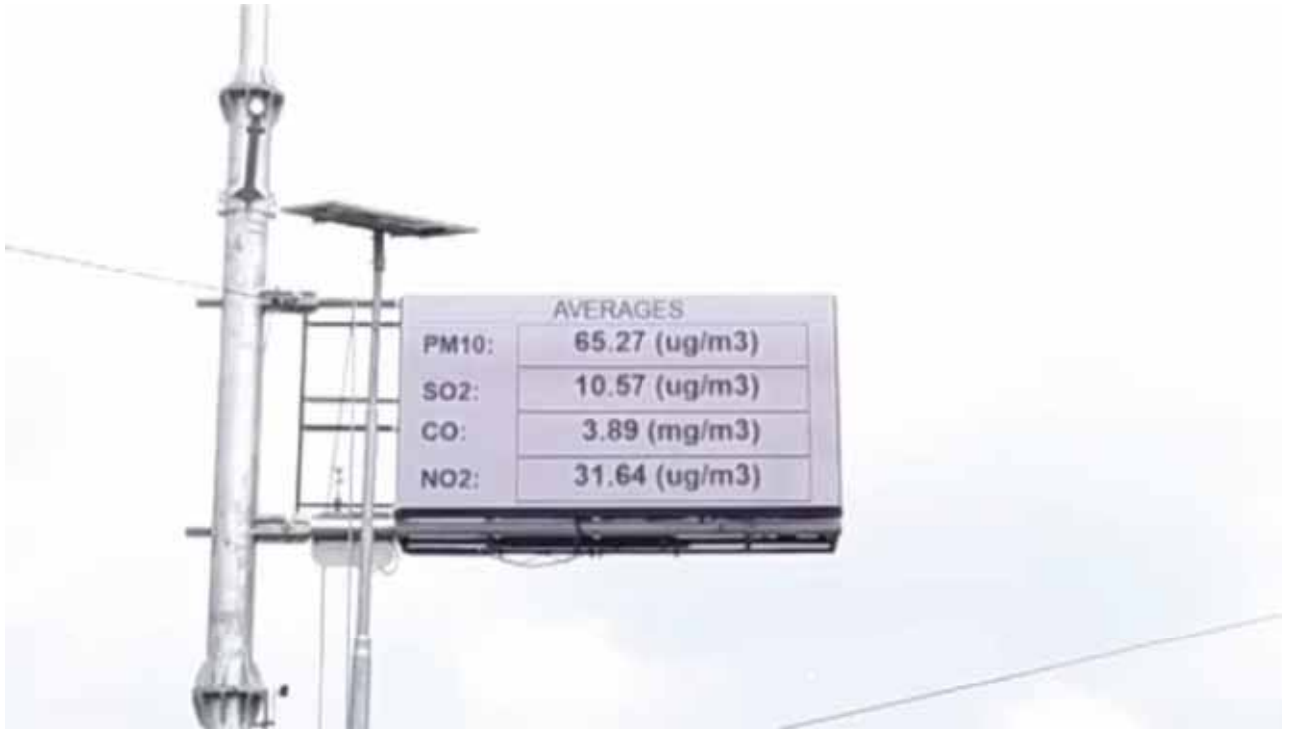
Road Traffic AQ Project



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Conclusion

- Sensor-based monitoring may democratise air quality industry through IOT and big data.
- Recognising the limitations, scientists are working on the harmonisation of evaluation standards.
- New applications will emerge through required performance criteria and not product certification schemes.
- Machine-learning and value-adding analytics are keys to a successful sensor product.

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Thank you!

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Air Quality Matters

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