

Vulnerability to air pollution: a building block in assessing vulnerability to multiple stressors

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Overview

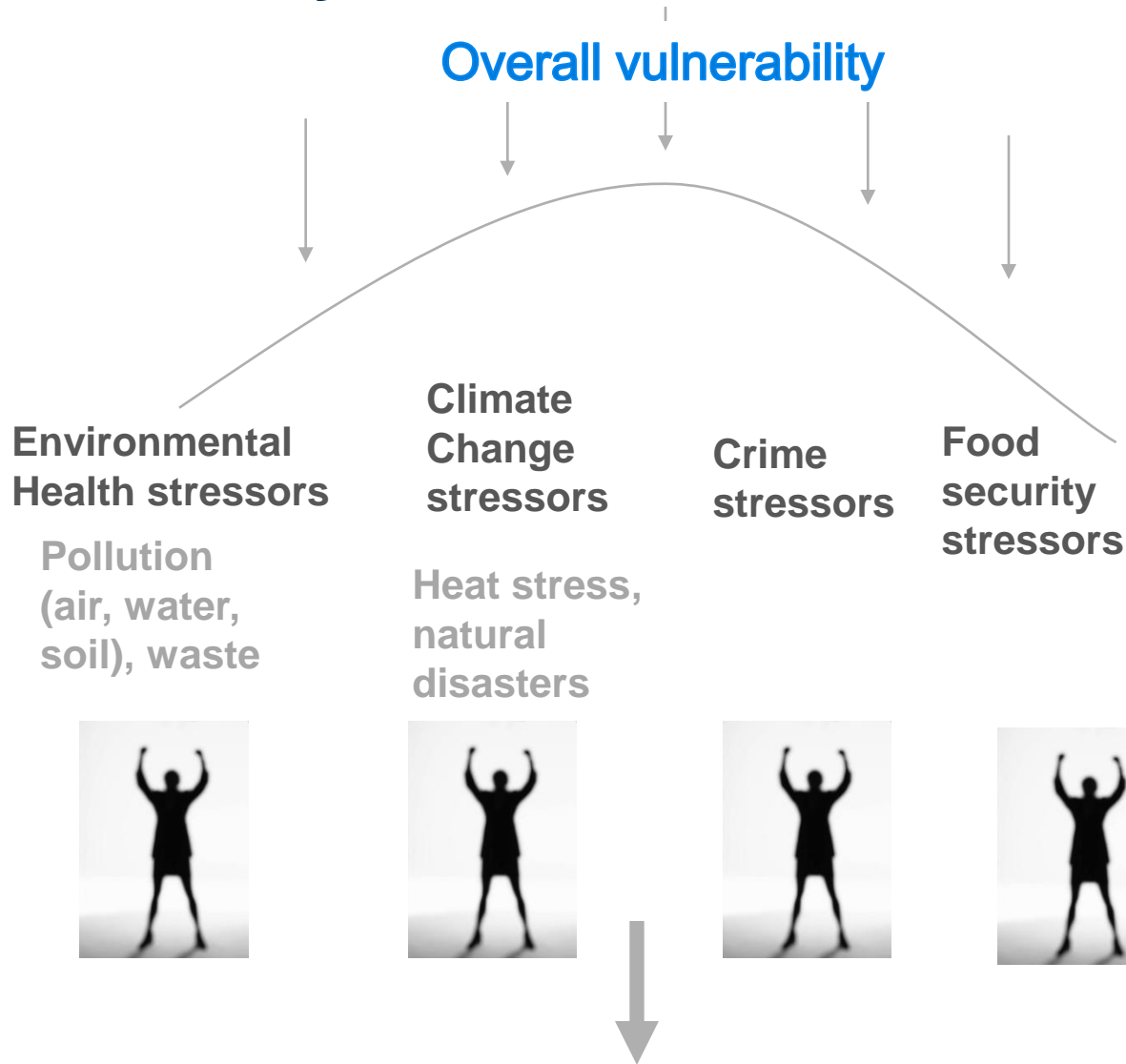
- Vulnerability
- Vulnerability assessment
 - Scope
 - Approach
 - Assessing vulnerability and communicating outcomes
 - Vulnerability vs resilience
 - Challenges
- Way forward
 - Model for a resilient community of opportunity



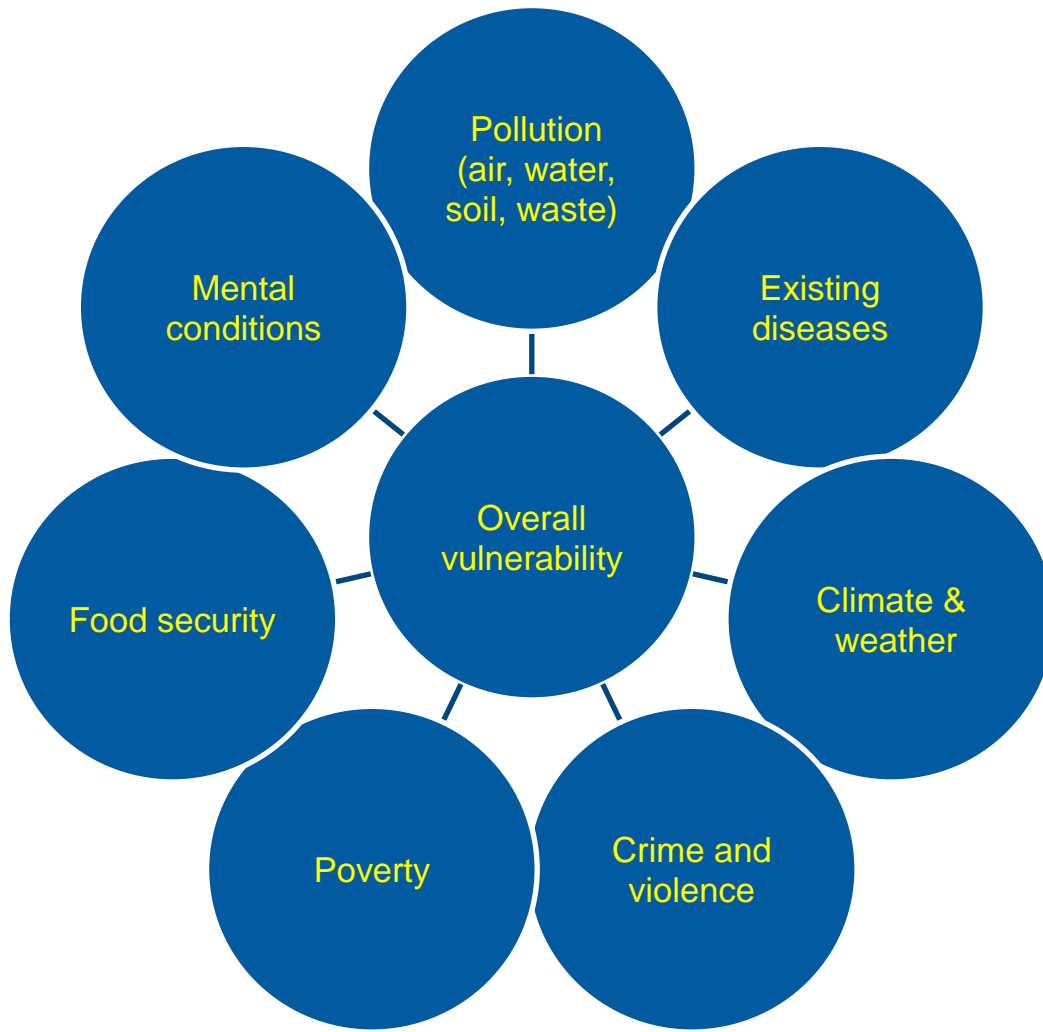
Vulnerability

- Definitions
 - Vulnerability may be defined as: the state of 'defencelessness, insecurity and exposure to risk, shocks, and stress' (Chambers, 1989).
 - Vulnerability represents the interface between exposure to the physical threats to human well-being and the capacity of people and communities to cope with those threats (UNEP, 2002).
- Elements of vulnerability
 - $V = f(E, S, AC)$
 - Where:
 - V = vulnerability
 - E = exposure
 - S = sensitivity or susceptibility
 - AC = adaptive capacity/coping/resilience

Vulnerability in context



Vulnerability to What?



Some practical examples

Many people:

- dependent on grants
- illiterate
- jobless
- with HIV/AIDS, TB
- AIDS orphans
- affected by crime and violence
- use dirty fuels

Many sewage plants don't function properly

Vulnerability Assessment - Scope

- Vulnerability of low income households and communities
- Questions that a vulnerability assessment should address
 - What are all the multiple stressors that we are concerned about?
 - What are the factors associated with each stressor?
 - What information do we need?
 - How do we collect the information we need?
 - What are the spatial and temporal scales of the assessment?
 - How will the assessment results be used?

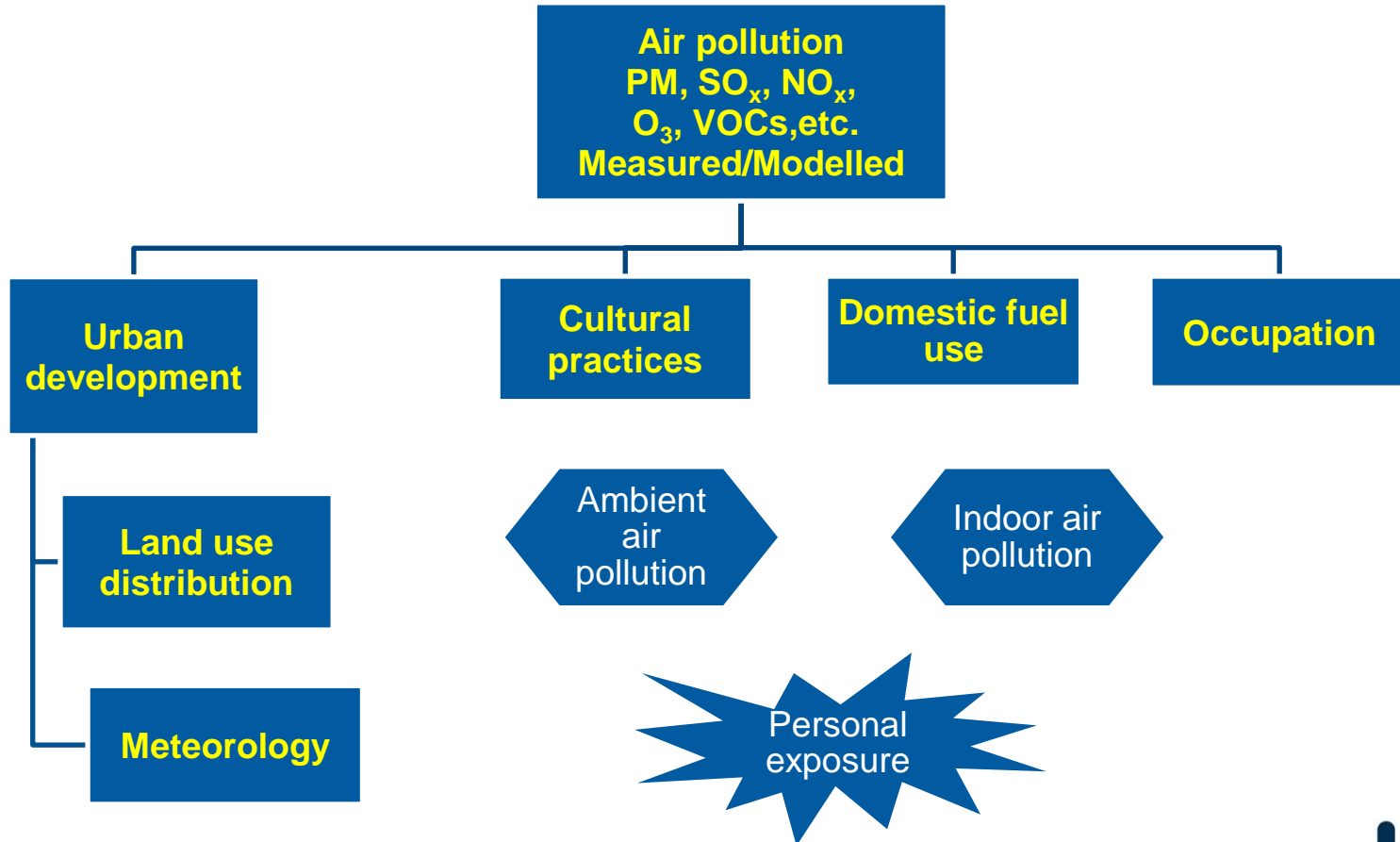
Information needs and how the results will be used, will determine the approach.

Vulnerability Assessment - Approach

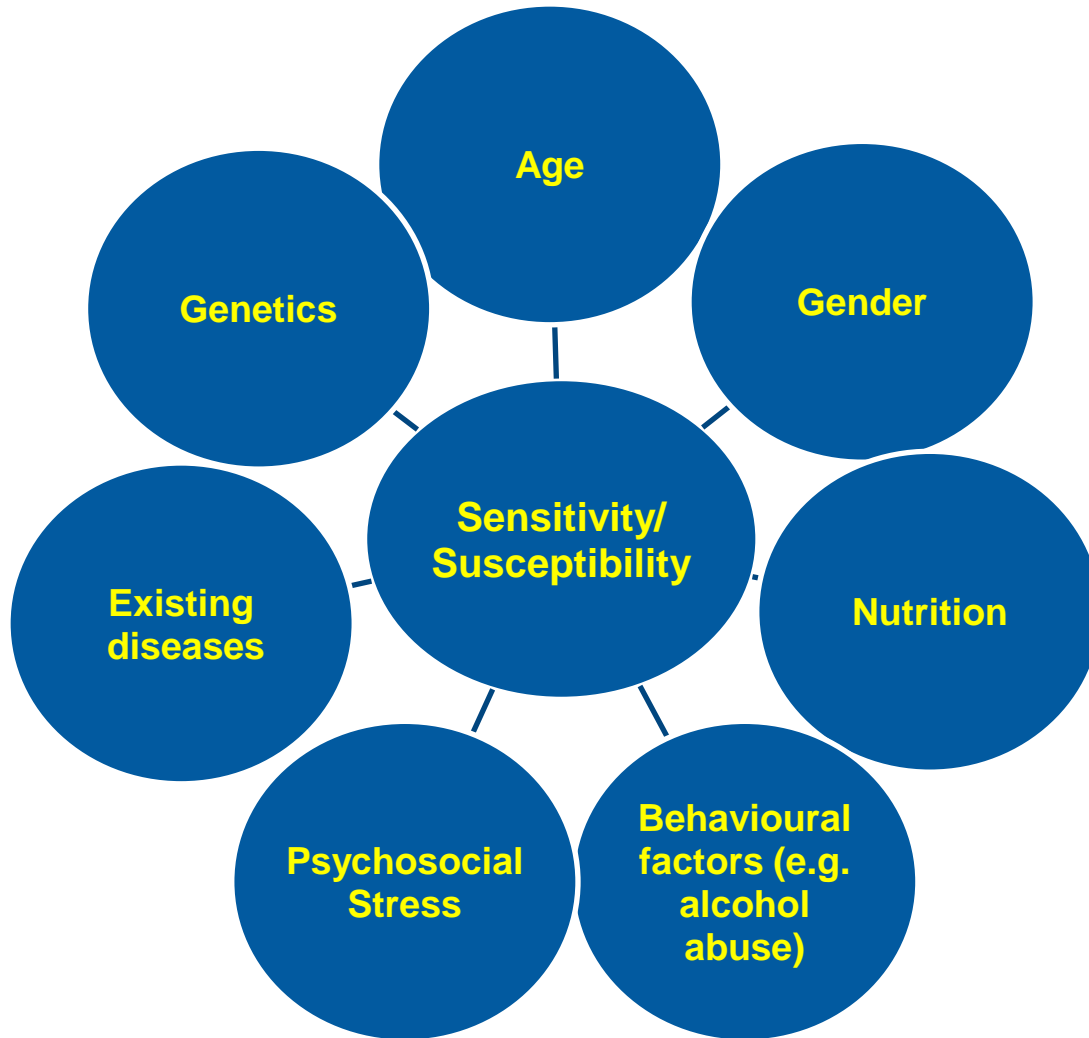
- Vulnerability to what? Air pollution
- Information requirements
 - Personal/household information framed by issues of
 - Exposure
 - Susceptibility
 - Coping/ adaptation
 - Land use and development plans
 - Air pollution concentrations
- Statistical tools to determine relationships among variables
- Identify appropriate indicators

The skills required, the cost and relevant stressors also determine the kind of data that can be generated and the overall quality of the assessment

Exposure to Air Pollution



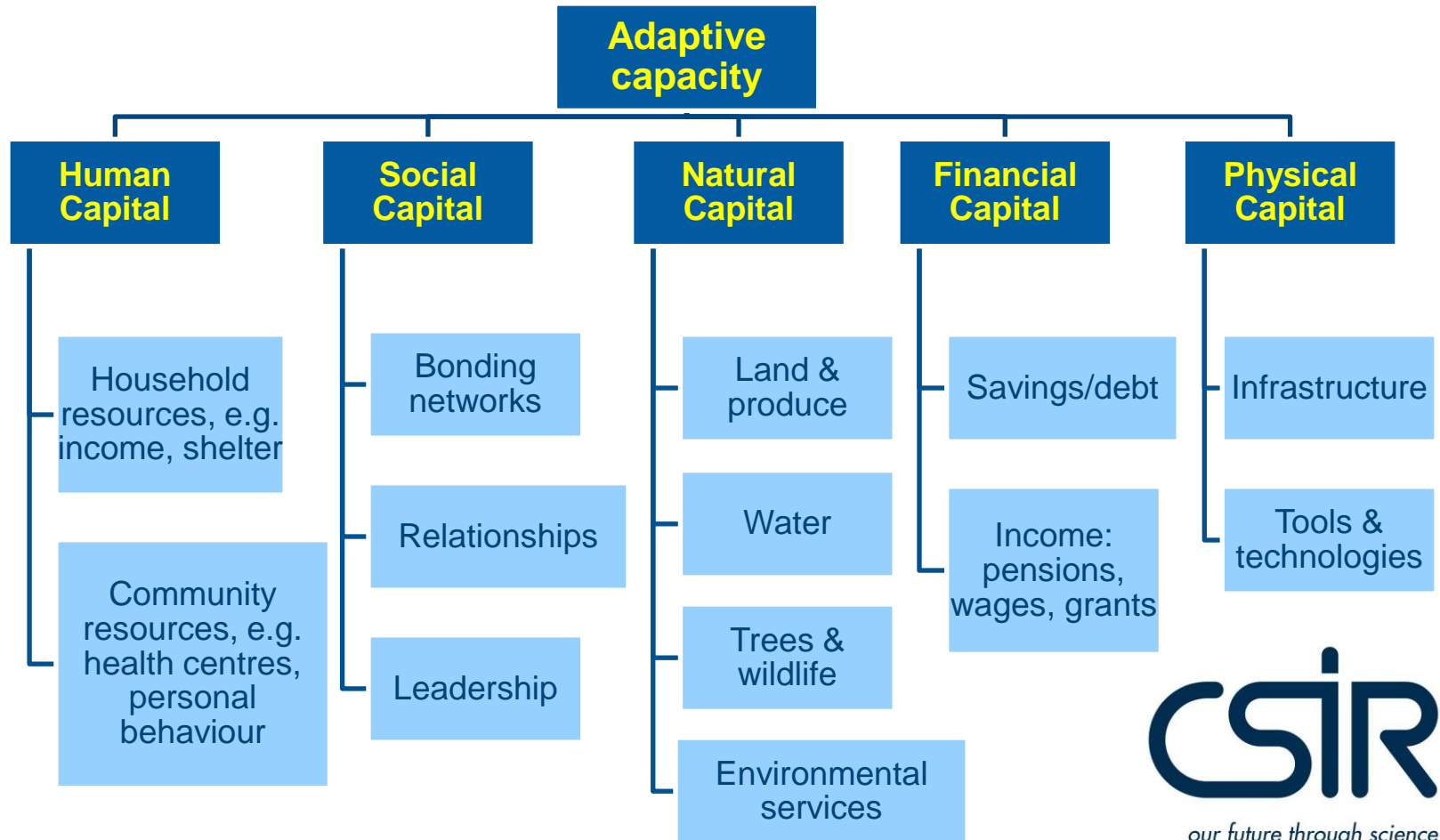
Sensitivity/Susceptibility to Air Pollution



To what degree is the community sensitive or susceptible to the effects of any set of stressors e.g. air pollution?

Adaptive Capacity/Coping related to Air Pollution Vulnerability

What are the existing technologies/capacities/resources/assets within communities that affect the ability of communities and individuals to recover, cope and/or adapt?



Application of Vulnerability Assessment

Tool	Level of application	Purpose
Customised predictive model	Household level	Assist in determining a risk profile at municipal level.
Modified baseline checklist	Household, Municipal or regional level	Vulnerability indicators for screening vulnerability at different levels
Structural equation modelling	Household level	Identify variables that are not directly observable, for intervention purposes.
Bayesian networks (BN)	Household level	Present an appropriate interface for creating <i>what-if</i> models that support complex decision-making and communication.

Application: Checklist

Place in vulnerability framework	Vulnerability factor	Indicator
Health outcome	Respiratory health	Asthma and pneumonia prevalence
Susceptibility – intrinsic (unavoidable)	Age	Proportion of people in vulnerable age group
Susceptibility - externally (acquired)	Nutrition	Regular consumption of vegetables: Household level: prevalence of hh eating fruits and or vegetables daily Municipal level: Vitamin A supplementation
Ability to cope/ accessibility	Socio-economic conditions	Prevalence of households not using piped water as source of water
Exposure	Lifestyle/ behaviour	Prevalence of smoking inside the house
Exposure	Fuel used for cooking	Prevalence of not using electricity for cooking

Communicating vulnerability

- Bayesian networks (BN) - a statistical technique used to visualise results from the customised predictive model by means of *what-if* scenarios
- Spider graphs
 - Household level: comparing odds ratios of different vulnerability factors
 - Municipal level: comparing prevalences of different vulnerability factors

Vulnerability vs Resilience



Vulnerability denotes a state of 'defencelessness, insecurity and exposure to risk, shocks, and stress' (Chambers, 1989).

Resilience denotes the ability to resist and/or recover from damage caused by the stressor and is the flipside of vulnerability (Turner et al., 2003)

Proposed way forward

- Incorporate air pollution vulnerability indicators to expand a current 'model of opportunity for a safe and secure South Africa' (Holtmann, 2010).
- Identify other multiple stresses and appropriate positive outcomes
- Identify indicators that measures achievement of positive outcome
- Through a collaborative approach, identify all relevant role players
- Outcome: 'a model for a resilient community of opportunity'.
- Incorporate into a process towards sustainable or healthy communities



Summary

- Framework can be expanded and applied to other stressors
- One size does not fit all
- Methodological challenges in addressing multiple stressors
- A multi-disciplinary team required
- Process should include all relevant role players
- Vulnerability assessment can help municipalities, industry and communities to achieve outcomes in a collaborative way.

Thank you