



## THE ROLE OF CONTEXT IN THE DEFINITION AND USE OF ENVIRONMENTAL INDICATORS

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# THE ROLE OF CONTEXT IN THE DEFINITION AND USE OF ENVIRONMENTAL INDICATORS

COST 356 Seminar:

*" Towards the definition of a measurable  
environmentally sustainable transport"*

Oslo, February 20, 2008

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# Why is context a concern?

- Discussed since the beginning of COST Action 356
- Task: can we establish 'better' indicators of EST?
- Raises issue of context:
  - Better for whom? (analyst, politician, decision supporter, public)
  - Better for what? (more detailed assessment? CBA or EIA? fuller representation of sustainability? ex ante? ex post?)
- Some indicators may be 'universal'; others not
- Examples:
  - 'Modal split compared to 1998' (EU, not elsewhere)
  - 'Emission density' (OK for some health aspects, not for others)
  - VKT/year (maybe OK for CO<sub>2</sub>, not for noise)
  - Deaths per 100.000 VKTs (policy); per km of road (citizen)
- Context is the surroundings where indicators are defined, designed and applied

## COST 356 analysis so far....

- Progress...Distinction between:
- *Physical* context (indicators as environmental measurements; main question: How to measure?),
  - The period of the source: day, night, year...
  - The position of the source: altitude, urban/rural
  - The initial state of the environment etc
- Strategies proposed to deal with it....
- *Decision* context (indicators as decision making tools; main questions: Why and what to measure?)
  - Purpose of assessment
  - Definition of (environmental) sustainability
  - Level of decision making
  - Who are taking part, who provide input who need output

# Conceptual model....

WHAT TO MEASURE?  
*Definition*

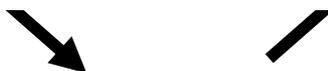
WHY TO MEASURE?  
*Use*



'THICK CONTEXT – ALL MATTERS'



'THIN CONTEXT - ONLY PHYSICAL MATTERS'



HOW TO MEASURE?  
*Design*

# Problems...

- "Searching with a very thin context generally produces results with too many answers to choose from"  
(<http://www.systems-thinking.org/mom/index.htm>)
- Indicators may be *based on* measurement (or calculations), but indicators *are* not measurements

## Example of indicator selection procedures..

Girardin et al 1999 (Agriculture)	Rochet & Rice 2005 (Fisheries)
1. Definition of objectives	1. Determine user needs
2. Choice of the type of user	2. Develop a list of candidate indicators
3. Construction of the indicator	3. Determine screening criteria
4. Determination of norms and veto thresholds	4. Score indicators against criteria
5. Sensitivity test	5. Summarize scoring results
6. Probability test (define 'probability zones')	6. Decide how many indicators are needed
7. Usefulness test	7. Make final selection
<b><i>'Pure' measurement is not a part.....</i></b>	8. Report on the suite of indicators

# Outlook

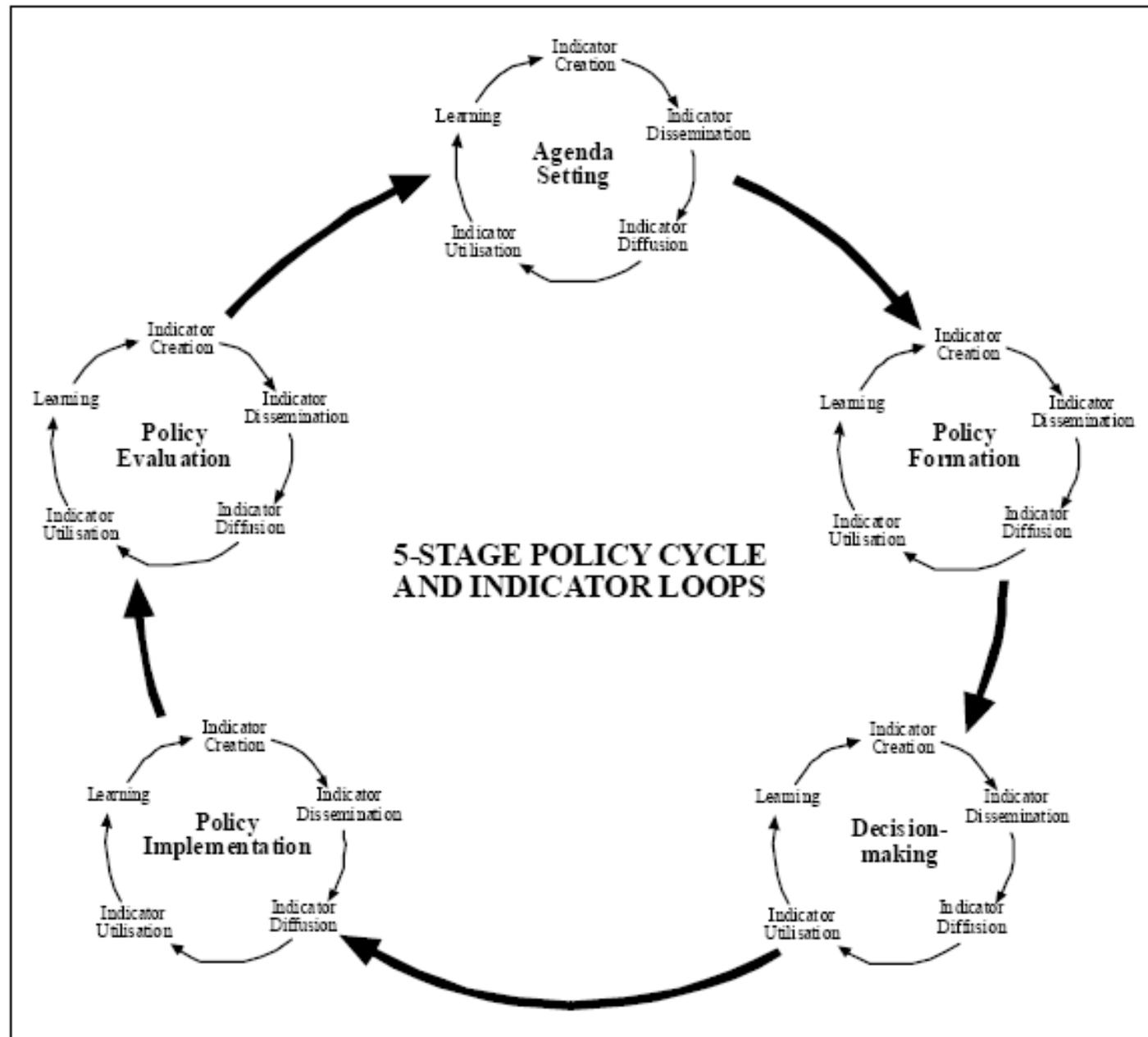
As work progresses:

- Continue to explore the border between 'universal' and 'context sensitive' elements in indicator development

This presentation:

- How does 'policy context' penetrate into environmental indicator development?
- Where and when could EST indicator definition benefit from considering which aspects of context?

# **Role of context in definition and use of indicators in general**



Science domain

Policy domain

- Borders between science and policy are blurred
- Not only 'knowledge transfer' but 'joint knowledge production'
- Ecological indicators are '**boundary objects**', scientific objects which both inhabit several intersecting social worlds and satisfy the informational requirements of each of them

Problem type	Well structured	Unstructured	Badly structured	Moderately structured
Policy process	Rule	Learning	Compromise	Negotiation
Role of scientist	Problem solver	Problem signaling	Accommodation	Advocacy
Use of knowledge	Data	Ideas	Concepts	Arguments

## Decision making context:

- Internal decision-making context:
  - purpose/objectives
  - role of participants
  - process employed to arrive at a decision
- External decision-making context
  - Resource constraints
  - Political interest, etc
- Experts are strongly influenced by contextual factors when they identify, interpret and use evidence (health policy recommendations)

Formal/Direct Channels

Informal/Indirect Channels

Dobrow et al 2004

# **Role of context in definition and use of indicators in transport**

# Transport evaluation methods as context

Methods for data collection	Methods for data analysis	Formal assessment techniques / aggregation
<ul style="list-style-type: none"> <li>• Surveys</li> <li>• Use of secondary data</li> <li>• Existing information / databases</li> <li>• Case studies</li> <li>• Focus groups</li> <li>• Natural observations</li> <li>• - Expert opinions</li> <li>• Programme documents</li> <li>• Literature reviews</li> </ul> <p><b>Giorgi &amp; Tandon 2002</b></p>	<ul style="list-style-type: none"> <li>• Statistical analysis</li> <li>• Models               <ul style="list-style-type: none"> <li>➤ Input/ Output</li> <li>➤ Micro-economic</li> <li>➤ Macro-economic</li> <li>➤ Statistical</li> </ul> </li> <li>• Non-statistical analysis               <ul style="list-style-type: none"> <li>➤ Expert panels</li> <li>➤ SWOT analysis</li> <li>➤ Colour vote</li> <li>➤ Benchmarking</li> <li>➤ Logical framework</li> <li>➤ Delphi survey</li> <li>➤ Group interviews</li> <li>➤ Meta-analysis</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Cost-benefit analysis</li> <li>• Cost-effectiveness analysis</li> <li>• Multi-criteria analysis</li> <li>• Scenarios</li> <li>• Impact assessment</li> <li>• Policy analysis</li> </ul>

### BOX 1

**The rational/analytical model  
(Simon)**

### BOX 2

**The 'muddling through' model  
(Lindblom)**

Even in 'technical' modelling and forecasting context matters for, e.g :

- What to assume about induced traffic
- How large is the study area to be
- When can models be considered satisfactorily calibrated
- Assessment set within prior policy and administrative decision framework.

Decision – choice between means  
|  
Implementation  
|  
Ex-post evaluation with multiple  
feedback at most stages

Partisan mutual adjustment  
|  
Satisfying behaviour – consensus  
seeking with multiple feedback at most  
stages

## 'Paradigms' (assessm. philos.) as context

- 'Experimentalism' (the rational model)
- 'Neo-classical economics' (consumer preferences)
- 'Managerialism' – (goals set by policy makers)
- 'Public choice' – Maximisation of self-interest for the decision makers (= political benefits)
- 'Pragmatism' – Enlightenment for decision makers and stakeholders
- 'Interpretivism' – Empowerment and education of all stakeholders; deliberative democracy as ideal
- 'Realistic evaluation'; aiming to identify causal mechanisms that are active in the specific context

# Transport indicators – phases of application

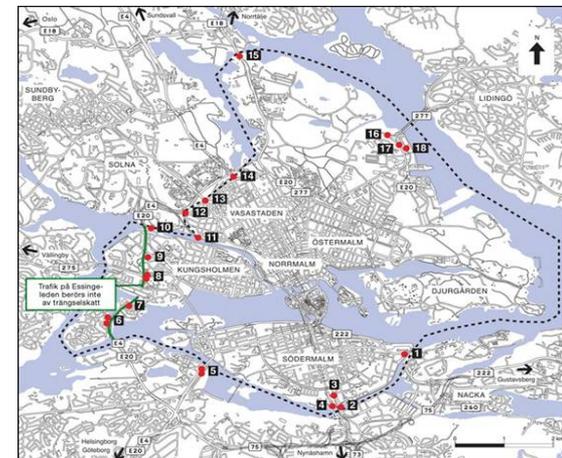
STAGE	Need for data (%)	Types of indicators and level of importance (5 = max)			
		Context	Output	Intermediate outcome	Outcome
Problem identification	100	3.9	3.0	2.7	3.4
Target setting	100	3.1	3.2	2.9	4.0
Option generation	94	2.9	4.0	3.4	3.2
Model development	100	2.7	3.6	4.3	3.3
Appraisal (ex ante)	94	2.5	3.6	3.8	3.5
Implementation	69	2.0	3.1	2.4	2.7
Evaluation (ex post)	81	2.2	4.0	3.6	4.3
Monitoring	88	2.5	3.3	4.3	4.5
Benchmarking	75	1.8	2.7	2.3	2.9
Average		2.6	3.4	3.3	3.5

# Stockholm Concession trial evaluation

Trial January- July 2006

Objectives:

- Reduce traffic volumes by 10-15% on the most congested roads
  - Increase the average speed
  - Reduce emissions of harmful pollutants and carbon dioxide
  - Improve the urban environment as perceived by Stockholm residents
- 
- Referendum sept 17, 2006
  - Permanent program from august 2007



# Influence of indicators in Stockholm Congestion Charging trial

Conceptualisation	Clearly defined measurement program for specified policy issues
Operationalization	Intensive data collection before, during, after
Communication	Almost instant reporting of key result indicators, extensive communication strategy, involvement of press, reference groups
Institutionalisation	Clear responsibilities, relative independence of monitoring unit, requirement to use results for specified decision

# Influence of TERM indicators on EU policy

<p>Conceptualisation</p>	<p>Clearly defined measurement program for specified issues and policy issues</p>
<p>Operationalization</p>	<p>Intensive in defining data sources, delays and variation of data</p>
<p>Communication</p>	<p>Annual activation of data, some attempts to increase effort compared to other indicators</p>
<p>Institutionalisation</p>	<p>Independent of policy, degree of policy adoption and linkage, no formal requirements to use the indicator report, no 'natural' policy venue</p>



# Role of context in definition and use of EST indicators

## EST in context....

- EST is a political concept, not exact:
- Defined by European union policy makers
- Sustainability comes in different varieties (weak, strong)
- System boundaries to be defined
- Transport is only partial contributor to environmental burdens

# Intended role of EST indicators is policy....

## TRB STI Subcommittee 2008:

- Allowing communities to compare themselves with others,
- Analyzing trends,
- Evaluating policy with regard to sustainability goals

## Johnston 2008:

- Sustainability assessment of modeled transportation and land use projects
- Sustainability assessment of policy packages

## Aparicio 2008:

- Focus the attention of decision makers on the environmental performance of the sector
- Communicate to the public about key challenges and strategies
- Improve co-operation with regional and local governments

## COST 356 Indicator definition

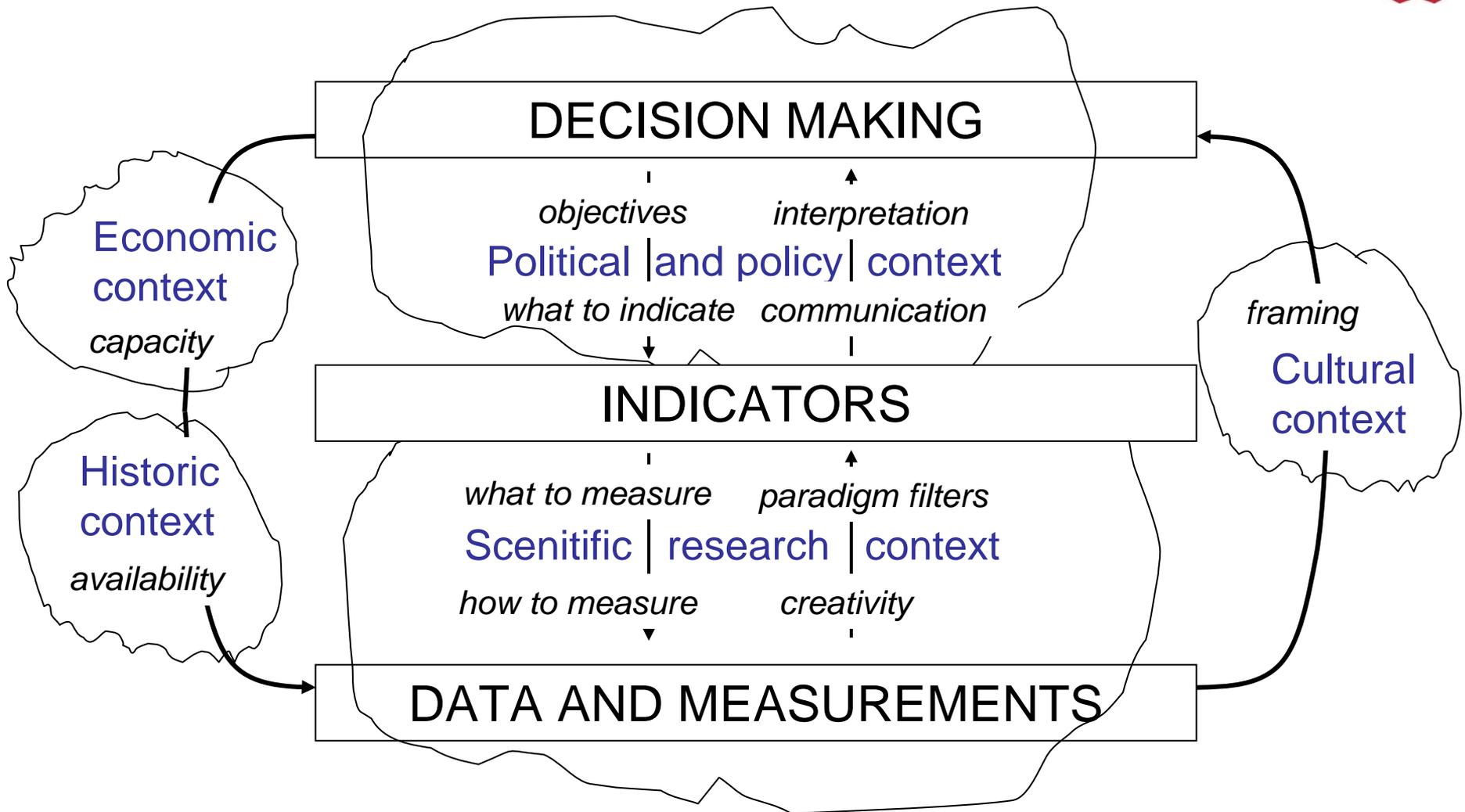
- *An indicator is a variable, based on measurements, representing as accurately as possible and necessary a phenomenon of interest to human beings*
- *An environmental impact indicator is a variable based on measurements, representing an impact of human activity on the environment, as accurately as possible and necessary*
- *An indicator of environmentally sustainable transport is a variable, based on measurements, representing potential or actual impacts on the environment, or factors that may cause such impacts, due to transport systems, flows or policies, as accurately as possible and necessary*

## EST Indicators should answer...

- a) *What is the transport contribution to each of the negative impacts on the environment? How can this contribution be measured or calculated?*
- b) *What is the full or aggregate impact contribution of transport on the environment, how can the full impact be assessed (measured, calculated, synthesized)?*
- c) *Are these contributions critical or not with regard to sustainability or other thresholds?*
- d) *In what way can or will these contributions change as a consequence of transport projects or policy measures?*

## EST indicators and context

<p><i>Transport contribution to each of the negative impact</i></p>	<ul style="list-style-type: none"> <li>• Identification of impacts are sensitive to 'historical' context</li> <li>• Transport system delimitations is sensitive to decision context</li> </ul>
<p><i>Aggregate impact contribution of transport</i></p>	<ul style="list-style-type: none"> <li>• Aggregation sensitive to 'paradigmatic' context in which aggregation takes place</li> </ul>
<p><i>Are these contributions critical for sustainability?</i></p>	<ul style="list-style-type: none"> <li>• Sustainability definition is sensitive to 'paradigmatic' context, both scientific and political</li> </ul>
<p><i>In what way can these change as a consequence of transport projects or policies?</i></p>	<ul style="list-style-type: none"> <li>• Transport measure assessment sensitive to policy level, phase, assessment paradigm, etc</li> </ul>



## Summary/discussion

- A decision-making context is characterised by its complexity, comprising of many different dimensions, policy, historic, user, paradigmatic, internal, external...
- Context is likely to influence both definition, design and use of indicators
- All parts of EST measurement are context sensitive
- Contextual influence is not bad in itself:
- Can help to make indicators useful and applied
- Can help to reduce "...too many answers to choose from"
- Option: allow case studies to provide explicitly considered contextual framing, as alternative/supplement to 'rigorous' comprehensive scientific measurement approach

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