Indicators for sustainability in transport - from conceptualization to utilization

Henrik Gudmundsson, DTU Transport
ITS Leeds, November 9, 2012
Overview

1. Indicator phenomenon – 

2. Conceptualisation 
   - Sustainability indicators 
   - ‘Sustainable transport’ and indicators 

4. Utilization 

5. Conclusions
1. Indicator phenomenon
Contributions to indicator reports
Canary birds were taken into the early mines in cages in order to detect the presence of the odorless and lethal gas, carbon monoxide.
An indicator of Climate Change

Variable

Values

Phenomenon of interest

MAUNA LOA OBSERVATORY, HAWAII
MONTHLY AVERAGE CARBON DIOXIDE CONCENTRATION

1958 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 00 02 04

YEAR
An indicator of congestion

Variable

Hours of Delay per Traveler

Phenomenon of interest

Values

Population Area Size

Very Large = more than 3 million
Large = 1 million to 3 million
Medium = 500,000 to 1 million
Small = Less than 500,000
A Definition of an indicator

• An indicator is a **variable**, which is selected for its ability to **represent** a wider **phenomenon of interest**; which is measurable in corresponding **value units**, and which supports **interpretation, evaluation** or **action** with regard to the phenomenon of interest

• Based on the Latin verb **indicare**:, meaning to point out, to announce, to give notice of, to determine, to estimate, to **betray**....
Misleading indicators: Deepwater Horizon

"Notwithstanding the tragic loss of life in the Gulf of Mexico, we achieved an exemplary statistical safety record as measured by our total recordable incident rate and total potential severity rate . . . As measured by these standards, we recorded the best year in safety performance in our company’s history."

(Source: Perrin 2011)
Ways to communicate an indicator

**Headline:**

Emissions are falling

- wyy hfggh
- fffkk g ggh bb
- bbb b b f fb fb

**Text**

- What is it about?
- What do we see?
- What does it mean?

**Signifier**

- Map
- Table
- Graph
- Image
1. Sustainability
Global sustainability policy

1972
UN Stockholm Summit

1980
World Conservation Strategy

1987
WCED

1992
UN Rio Summit

2000
UN Millenium Summit

2012
UN Rio +20

Global political environmental awareness

’Sustainable Development’ term coined

WCED: ’Sustainable Development’ defined:
• Present and future needs
• Within environmental limits
• Eliminate absolute poverty
• SD a process

UN Rio +20: ‘Renew commitment to SD
• ‘Green Economy’ as means to achieve SD
• Integration among 3 pillars
• Strengthen institutional Framew.
• Goals and indicators of SD 2015?

UN Millenium Summit: ’Millenium Development goals’
• Classic development issues (Poverty, Health, Education) + env.

UN Rio +20: ‘Green Economy’ as means to achieve SD
• Integration among 3 pillars
• Strengthen institutional Framew.
• Goals and indicators of SD 2015?
Sustainability: Scientific strains

- Fisheries: ‘Maximum Sustainable Yield’ ≈ 50% of carrying capacity (1931)
- Economy: Hicks’ Income: ‘The maximum amount that could be spent on consumption in one period without reducing real consumption in future periods’
- Ecology: Vulnerability and complexity of ecosystems
  - Renewable resources more critical
  - Diversity and Resilience
  - ‘MSY’ is problematic because of multiple ecosystem services
- Ecological Economics:
  - ‘Limit scale of the economy to what the biosphere can sustain’
  - ‘Preserve Natural Capital intact’
- ‘Strong sustainability’
- TNC = NNC + RNC to be constant

‘Use forests in a way that future generations will have at least as much benefit as the living generation’

Hartwick Rule: ‘To maintain income over time all rents extracted from non-renewable capital must be reinvested in other capital’

‘Weak Sustainability’

\[ Z = S/Y - dM/Y - dN/Y \]
Environment

HUMANS
- Noise
- Air quality
- Water quality
- Cultural heritage

NATURE
- Landscapes
- Natural resources
- Toxic and radioactive waste
- Global warming
- Ecosystems and Biodiversity

PRESENT → FUTURE
Society

PRESENT

• Equity within present generation
• Eliminate poverty
• Quality of life
• Health
• Education

FUTURE

• Equity towards future generations
• Social coherence
• Social stability
• .....
### Dimensions and principles of sustainable development

**INSTITUTIONAL DIMENSION**
- Integrate decision making
- Ensure participation of major groups

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<thead>
<tr>
<th><strong>PRESENT GENERATION</strong> (Development)</th>
<th><strong>ECONOMIC PILLAR</strong></th>
<th><strong>SOCIAL PILLAR</strong></th>
<th><strong>ENVIRONMENT PILLAR</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Fair distribution between generations</strong></td>
<td>• Ensure rising income level for the present generation&lt;br&gt;• Ensure fair distribution</td>
<td>• Ensure human well-being and development;&lt;br&gt;• Ensure fair distribution and eliminate poverty</td>
<td>• Ensure environmental quality for the present;&lt;br&gt;• Ensure environmental justice</td>
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</table>

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<thead>
<tr>
<th><strong>FUTURE GENERATIONS</strong> (Sustainability)</th>
<th><strong>ECONOMIC PILLAR</strong></th>
<th><strong>SOCIAL PILLAR</strong></th>
<th><strong>ENVIRONMENT PILLAR</strong></th>
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<tbody>
<tr>
<td><strong>Safeguard income opportunities for future generations (economic capital)</strong></td>
<td>• Maintain capacity for interaction and stability of social systems (social capital)</td>
<td>• Protect nature’s life-support systems and resources (Ecosystems, Climate, Biodiversity)...</td>
<td></td>
</tr>
</tbody>
</table>
3) ’Sustainable Transport
Project level impacts

- Noise
- Landscape intrusion
- Aesthetics
- Air Quality
- Water flows
- Safety
- Costs/benefits

System level impacts

- Total energy consumption
- Total material requirement
- Total emissions and waste
- Total consumption of land
  - Economic development
  - Connectivity
  - Social coesion
### Indicators of sustainable transport

#### INSTITUTIONAL DIMENSION
- Transportation/land use integration; Multi-modal planning; interagency coordination
- Participatory planning; Partnerships

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</table>
| Fair distribution between generations | • Transportation contributions to economic access  
• Transportation costs (time and money)  
• External costs associated with congestion and accidents  
• Maintenance costs | • Social accessibility; Mobility; Safety  
Liveability  
• Mobility barriers for the disadvantaged  
• Health effects (obesity/Exercise)  
• Social exclusion | • Air quality effects on health  
• Air pollution effects on vegetation  
• Noise effects  
• Visual intrusion  
• Soil and water pollution  
• Waste production |

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<tr>
<th>FUTURE GENERATIONS (Sustainability)</th>
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</thead>
</table>
| • Value of transportation assets  
• contribution to innovations  
• Use of non-renewable resources and energy | • Connectivity  
• Effects on cultural heritage | | • Climate Change  
• Damage to ecosystems  
• Fragmentation of habitats  
• Release of toxic substances  
• Introduction of invasive species |
Indicator frameworks

- **Conceptual** dimension: *What to measure*
  (which impacts, system boundary, system interactions...)

- **Intentional** dimension: *Why to measure?*
  (which purpose, function, users)

- **Procedural** dimension: *How to measure?*
  (which indicators, measurement methods, reporting formats)
4. Utilization
What can we do with indicators?

Alert – What is going on?
Forecast – Where are we heading?
Review – How are we doing?
Diagnose – How did we get here?
Decide – What should we do?
Account – Who is responsible?
Learn – How can we do better?
Non – use?

• “A substantial literature on knowledge utilization documents how little, on the whole, formal analysis and information influence decisions”

• “…when information is most influential, it is also most invisible. That is, it influences most when it is part of policy participants’ assumptions and their problem definitions, which they rarely examine”  
  *(J.E. Innes 1998)*

• “…Indicators do not drive policy. People are not suddenly converted because they are confronted with data, no matter how expertly or how collaboratively designed. Compendia of indicators are not used by policy makers as aids to decision” 
  *(Innes & Booher 2000)*
Concepts to analyse use and influence

Use:
• Indicators are observed and processed
• Indicators are referred to

Influence:
• Indicators affect policy content (goals, measures), or processes

Different influence roles:
• *Instrumental*: Indicators have direct influence on decisions
• *Conceptual*: Indicators increase knowledge or create new ideas
• *Symbolic*: Indicators justify existing decisions
• *Process*: Indicators structure the policy making process
Transport policy study in POINT

Two transport cases:

• **Sweden**: Indicators in annual reports that *Follow-up on the Swedish Transport Policy Objectives* (Focus on 2008-report)

• **European Union**: indicators developed for the Mid-term Review of a transport white paper, *Keep Europe Moving*, 2006, in the socalled ASSESS study
Swedish case (1) - Governance model

• Significant independence for government agencies

• “Management by objectives” (MBO) as a key philosophy: political objectives combined with some agency discretion

• Transport policy objective: “to ensure socially and economically efficient and long-term sustainable transport resources for the public and industry throughout Sweden.”

• Six subsidiary objectives (until 2009), and intermediate targets
Swedish case (2) - ‘SIKA’ report

• Published annually since 1996
• Partly based on detailed annual reports from transport agencies
• Aims,
  • to inform the annual State Budget
  • to inform strategic planning
• Includes statistics, quantitative indicators and qualitative assessments
• Some indicators are descriptive, other evaluative
• Structured according to the transport policy objective and targets
## Swedish case (3) - ‘SIKA’ report

<table>
<thead>
<tr>
<th>SUBSIDIARY OBJECTIVE</th>
<th>Development towards the long term subsidiary in 2005</th>
<th>Are the subsidiary objectives complied with by the decisions made</th>
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</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Yes</td>
<td>Yes?</td>
</tr>
<tr>
<td>Regional development</td>
<td>Uncertain</td>
<td>Objective lacking</td>
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<tr>
<td>Gender equality</td>
<td>No</td>
<td>Objective lacking</td>
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<tr>
<td>Transport quality</td>
<td>Yes</td>
<td>Yes?</td>
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<tr>
<td>Safe traffic</td>
<td>Uncertain</td>
<td>No</td>
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<tr>
<td>Environment</td>
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<tr>
<td>- <em>Effect on climate</em> (CO₂)</td>
<td>No</td>
<td>No</td>
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<tr>
<td>- <em>Air pollution</em> (SO₂, NOₓ, VOC)</td>
<td>No</td>
<td>No</td>
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<tr>
<td>- Noise</td>
<td>No</td>
<td>No</td>
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<tr>
<td>- <em>Ecocycle adaptation</em></td>
<td>Uncertain</td>
<td>Objective lacking</td>
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<tr>
<td>- <em>Impact on natural and cultural environment</em></td>
<td>Uncertain</td>
<td>Objective lacking</td>
</tr>
</tbody>
</table>
Swedish case (4) - observations

• The reports are known and sometimes referred to by civil servants, transport politicians, and stakeholders (= it is used), although less so by politicians

• It was not possible to confirm cases where the indicators had a direct instrumental role in any decisions (except possibly one)

• It seems likely that the indicators has some conceptual and process role, and particularly a symbolic role: to confirm the MBO philosophy as a rational approach
EU case (1) – European Transport Policy

- ‘White Papers’ as key strategic documents (1992; 2001; 2011)
- Key objectives in the 2001 White Paper “Time to decide”:
  - “to decouple economic growth from transport growth,
  - “modal shift - returning by 2010 to the 1998 modal split
- Focus on **Mid-term review** of 2001 WP; Only ‘internal’ process in the Commission studied
- After Mid-term review these objectives were abandoned
The ASSESS study contributed to the Mid term evaluation, "Keep Europe Moving" in 2006.

ASSESS used indicators to evaluate European Transport performance

adopting an ex ante approach (forecasting to 2010; 2010) based on series of models

Approach developed in close contact with Commission staff
### Table 21: Transport performance in EU25 for all 4 scenarios, relative to 2000(=100)

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<td>pkm/population</td>
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<td>107</td>
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<td>tkm/ton</td>
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<td><strong>GDP (baseline)</strong></td>
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<td>euro</td>
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<td><strong>GDP+ (impact)</strong></td>
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<td><strong>employment (baseline)</strong></td>
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<td>88</td>
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<td>106</td>
<td>114</td>
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<td><strong>land take</strong></td>
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<td>km² road</td>
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‘Keep Europe Moving’, EC 2006
EU case (4) - observations

- The ASSESS study is used in the Mid-term review; evidenced in the documents and interviews
- The ASSESS study supports policy changes:
  - Former objectivees impossible to reach with adopted measures
  - Modal split (and decoupling) of limited effects to reach sustainability objectives; technology (pricing) more effective
- The influence is probably not directly instrumental
- The influence in to demonstrate and rationalize reasons for policy changes underway for other reasons
Conclusions - Transport Policy cases (1)

- Indicators are referred to in documents, the reports are processed to; interviewees talk about use => use.
- Influence is more evident in the EU case than the Swedish case.
- The EU case indicates influence on policy agenda and objectives – indicators contribute to rationalizing.
- In the Swedish case influence is mainly conceptual (confirm targets), and procedural (confirm philosophy of MBO).
What makes indicators influential? (1)

‘Positivist’ approach:
• Indicators explaining the causes of a development will point to effective policy levers (diagnostics)

‘Historicist approach:
• Indicators must tell a convincing story, and thereby compel actors to act (awareness)

(Source: Cobb & Rixford 1998)
What makes indicators influential? (2)

Government approach:
• Provides useful information to formal decision making; Institutional integration

Governance approach:
• Provides stakeholders with a common perspective; support to collaborative processes

(Source: Eckerberg & Mineur 2003)
Conclusion - Why do we need indicators?

• The world is complex; there is a need for knowledge and measurement to manage it; “what gets measured, gets done”

• Everything cannot be considered, there is a need for selected information about the most important issues

• Some problems can not be measured or modelled directly, it is necessary to use indirect/approximate variables

• All tools and methods for assessment require some form of indicators

• “Sustainable Transport” is a good example of all these
What can we do with indicators?

- Negotiate and carve a niche for the future!
Final conclusions

• Indicators are necessary to guide policy

• Sustainability indicators: to carve a niche for the future

• Indicator ‘existence’ does not mean ‘use’

• Indicator ‘use’ does not mean ‘influence’

• Indicator ‘influence’ does not mean ‘positive influence’