Transitions in knowledge for knowledge in transitions: Towards a paradigm shift in higher education?
Challenge of 21st century: 10 billion people, 1 planet

Education, health, food, housing, safety

Good life

Water, forests, oceans, biodiversity, climate, resources

Within limits of the planet

(Global Footprint Network, 2012; UNDP, 2014)
Global response: Sustainable Development Goals

1. No Poverty
2. No Hunger
3. Good Health
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Renewable Energy
8. Good Jobs and Economic Growth
9. Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace and Justice
17. Partnerships for the Goals

European Environment Agency
EU Policy framework – 7th Environment Action Programme

Living well, within the limits of our planet

7th Environment Action Programme
Vision of the 7th Environment Action Programme

‘In 2050, we live well, within the planet's ecological limits.

Our prosperity and healthy environment stem from an innovative, **circular economy** where nothing is wasted and where natural resources are managed sustainably, and **biodiversity is protected**, valued and restored in ways that enhance our society's resilience.

Our **low-carbon growth** has long been decoupled from resource use, setting the pace for a global safe and sustainable society.’

Rethinking sustainable development?

Of course not!
Living well, within the limits of the planet

ECOSYSTEMS

SOCIO-TECHNICAL SYSTEMS
meeting social needs and providing value

- Energy system
- Food system
- Mobility system
- Urban system

Resources and ecosystem services

Waste and emissions

Policy

Values, culture, behaviour

Technology

Science

Industry

Market

European Environment Agency
Implicit order?
Globalisation of unsustainable systems of production and consumption
Earth system trends

Global trends

Expectations/policy promises

OR

How feasible?
How credible?
What sort of knowledge?
This could be our best century ever, or our worst

Dr James Martin, founder Oxford Martin School
Paradigm shift in knowledge and policies?

Normal Science
- Puzzle solving stage
- Scientists share common paradigm
- make measurements
- articulate theory
- make predictions

New Paradigm
- Scientists return to routine
- Revolution becomes invisible

Pre-paradigm phase
- Alternative concepts compete
- Anarchic period
- Fact gathering appears unguided

Anomaly
- Blame apparatus
- Set aside problem
- Modify paradigm

Crisis
- Anomaly too problematic
- Faith in paradigm shaken

Change in World View
- Gestalt shift
- Problem seen from different perspective
- New paradigms explored

THE STRUCTURE OF SCIENTIFIC REVOLUTIONS
By THOMAS S. KUHN
“Over the past 40 years, a broad range of environment legislation has been put in place, amounting to the most comprehensive modern standards in the world. This has helped to address some of the most serious environmental concerns.” (7EAP)

Policy theory: initially ‘fighting pollution’

Knowledge paradigm: “Union environment policy is based on environmental monitoring, data, indicators and assessments linked to the implementation of Union legislation, as well as formal scientific research....” (7EAP)
“However, many environmental trends in the Union continue to be a cause for concern, not least due to insufficient implementation of existing Union environment legislation.” (7EAP)

“Addressing some of those complex issues requires tapping into the full potential of existing environmental technology [...] as well as increased use of market-based instruments.” (7EAP)

**Modify policy theory:** Efficiency thinking

**Modify knowledge:** Efficiency; market-based instruments; BAT studies; voluntary instruments
### Thematic priority objective 1: Protecting, conserving and enhancing natural capital

<table>
<thead>
<tr>
<th>Category</th>
<th>Past (6–10 year) trends</th>
<th>20+ years outlook</th>
<th>Progress to policy targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrestrial and freshwater biodiversity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land use and soil functions</td>
<td></td>
<td></td>
<td>No target</td>
</tr>
<tr>
<td>Ecological status of freshwater bodies</td>
<td></td>
<td></td>
<td>◯</td>
</tr>
<tr>
<td>Water quality and nutrient loading</td>
<td>▶️</td>
<td>▶️</td>
<td>◯</td>
</tr>
<tr>
<td>Air pollution and its ecosystem impacts</td>
<td>▶️</td>
<td>▶️</td>
<td>◯</td>
</tr>
<tr>
<td>Marine and coastal biodiversity</td>
<td></td>
<td></td>
<td>◯</td>
</tr>
<tr>
<td>Climate change impacts on ecosystems</td>
<td></td>
<td></td>
<td>No target</td>
</tr>
</tbody>
</table>

- **Improving trends dominate**: Green (☑️)
- **Trends show mixed picture**: Yellow (☐)
- **Deteriorating trends dominate**: Red (☒)

Source: EEA. SOER 2015 Synthesis report.
## Thematic priority objective 1: Protecting, conserving and enhancing natural capital

<table>
<thead>
<tr>
<th>Environmental Component</th>
<th>Past (6–10 year) trends</th>
<th>20+ years outlook</th>
<th>Progress to policy targets</th>
</tr>
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<tbody>
<tr>
<td>Terrestrial and freshwater biodiversity</td>
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<td>✗</td>
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</tr>
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<td>Climate change impacts on ecosystems</td>
<td></td>
<td></td>
<td>No target</td>
</tr>
</tbody>
</table>

- **Improving trends dominate**: Green (☑)  
- **Trends show mixed picture**: Yellow (☐)  
- **Deteriorating trends dominate**: Red (✗)  

Source: EEA. SOER 2015 Synthesis report.
Thematic priority objective 3: Safeguarding from environmental risks to health

<table>
<thead>
<tr>
<th>Environmental Health Risks</th>
<th>Past (6–10 year) trends</th>
<th>20+ years outlook</th>
<th>Progress to policy targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water pollution and related environmental health risks</td>
<td>Largely on track</td>
<td></td>
<td>✓ / □</td>
</tr>
<tr>
<td>Air pollution and related environmental health risks</td>
<td></td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Noise pollution (especially in urban areas)</td>
<td></td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Urban systems and grey infrastructure</td>
<td></td>
<td></td>
<td>No target</td>
</tr>
<tr>
<td>Climate change and related environmental health risks</td>
<td></td>
<td></td>
<td>No target</td>
</tr>
<tr>
<td>Chemicals and related environmental health risks</td>
<td>Largely not on track</td>
<td></td>
<td>□ / ×</td>
</tr>
</tbody>
</table>

Improving trends dominate: Green
Trends show mixed picture: Yellow
Deteriorating trends dominate: Red
Largely on track: ✓
Partially on track: □
Largely not on track: ×

Source: EEA. SOER 2015 Synthesis report.
Challenges for established governance approaches

Are they addressing the underlying drivers of environmental degradation?

In 2001, the EU set itself the target to halt biodiversity loss in the EU by 2010.

In 2011, the EU set the target to ‘halt loss of biodiversity and degradation of ecosystem services in the EU by 2020’.

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2020 Headline Target</td>
<td>No significant progress</td>
</tr>
<tr>
<td>Halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restore them in so far as feasible, while stepping up the EU contribution to a sustainable global biodiversity loss reduction framework</td>
<td>Overall, h2020 had a slightly positive impact on ecosystem services in the EU but missed its headline, as confirmed by the report. This is consistent with indications for the capacity of nature to provide ecosystem services in the future. While many local successes on the ground deliver positive outcomes, these do not add up to have a measurable impact on the overall biodiversity status.</td>
</tr>
</tbody>
</table>

Next? ‘2030’? Or, addressing the fundamental drivers?

Source: Mid-term review of the EU biodiversity strategy
“Together with current wasteful production and consumption systems in the world economy, [...] depletion of resources [...], generating more pollution and waste, increasing global GHG emissions and exacerbating land degradation, deforestation and biodiversity loss.” (7EAP)

“This report has come to the conclusion that traditional incremental approaches based on the efficiency approach will not suffice. Rather, unsustainable systems of production and consumption require fundamental rethinking in the light of European and global realities.” (SOER2015)
The overall picture: Efficiency improvements have not secured long-term resilience

Protecting, conserving and enhancing natural capital
Resource efficiency and the low-carbon economy
Safeguarding from environmental risks to health

Past (5–10) year trends
Improving trends dominate
Trends show mixed picture
Deteriorating trends dominate

20+ years outlook
Improving trends dominate
Trends show mixed picture

Source: EEA. SOER 2015 Synthesis report.
Institutional vs ecosystem developments

Different explanations:
- Counterfactual
- Implementation GAP
- Better regulation
- Time-lag effect
- Institutional solutions don’t address the core issues!
EU GHG emissions from transport

25 years of efficiency gains and fighting pollution

Lack of decoupling

2030 transport target (+8% on 1990 levels)

2050 transport target (60% reduction on 1990)

Limits of the current techno-efficiency paradigm
“Biodiversity, including the ecosystem services it provides (natural capital), for its intrinsic value and for its essential contribution to human well-being and economic prosperity.”

“The current knowledge base [...] has gaps [...] required to meet emerging policy demands. These gaps call for actions to widen the knowledge base [...] in the coming decade. “... systems science; complex environmental change and systemic risks; global megatrends; interplay between socio-economic and environmental factors; transitions in production-consumption systems; environmental risks to health; and the inter-relationships between economic development, environmental change and human well-being.” (7EAP)
Changes in understanding

Changing global context: impact and role for Europe?
Transitions

= fundamental shifts in the systems that fulfill societal needs, through profound changes in dominant structures, practices, technologies, policies, lifestyles, thinking ... 

... in line with the sustainable development ambitions and objectives embedded in the Sustainable Development Goals
Achieving needed change requires system innovation.

Source: UNEP (from Wetering et al., 1997)
Evolving policy responses: macro-integrated approach

- **Long-term**: 2030-2050-2100
- **Integrated**: e.g. Common Agricultural Policy
- **Systemic**: e.g. Decarbonisation of transport
- **Developing/iterative**: e.g. Circular Economy; Climate and Energy
- Require a different governance approach
- Thus, complex, uncertain, lacking knowledge (of a certain type)
In the direction of a new paradigm

Normal Science
Puzzle solving stage
Scientists share common paradigm
- make measurements
- articulate theory
- make predictions

New Paradigm
Scientists return to routine
Revolution becomes invisible

Pre-paradigm phase
Alternative concepts compete
Anarchic period
Fact gathering appears unguided

Change in World View
Gestalt shift
Problem seen from different perspective
New paradigms explored

“The transition to a green economy is a long-term, multi-dimensional and fundamental process that will require a move away from the current linear economic model...” (SOER2015)

Alternative concepts:

Unguided fact gathering: e.g. green economy; green investments; green finance; circular economy; green jobs; smart cities; ...

Europe’s emerging transition agenda
Making sense of the Green, Blue, Circular, Resource Efficient, Low Carbon, Bio, Smart, Digital Economy?
Taking a fundamental **systems** perspective

**Food in a green light**
A systems approach to sustainable food

**FOOD AND NUTRITION SECURITY**
- Stability
- Utilisation
- Nutritional value
- Food safety

**FOOD AVAILABILITY**
- Production
- Distribution
- Trade

**FOOD ACCESS**
- Affordability
- Accessibility
- Preference

**ECOSYSTEM HEALTH**
- Resilience
- Biodiversity
- Ecosystem functions
- Ecosystem services

**SOCIAL WELL-BEING**
- Income
- Employment
- Health
- Equity
- Culture
- Ethics

**INPUT INDUSTRY**
- Farmers and horticulturalists: 11,989,000
- Fishers and aquafarmers: 98,000

**FOOD AND DRINK MANUFACTURERS**
- 289,000

**WHOLESALE AND SUPPLIERS**
- 208,000

**RETAIL AND SERVICES**
- 2,550,000

**CONSUMERS**
- 505,572,000

European Environment Agency
Serious reflection on policy implications?

Source: 2017 EEA elaboration on Stockholm Resilience Center’s original image
Creating **pathways** to sustainability

**High carbon economy**

- 20%

**Low carbon economy**

- 40%

Lock-in

European Environment Agency
Systemic change combines multiple innovations

Environmental performance

Sustainable state

Initial state

Niche innovations

Source: Loorbach

European Environment Agency
Long-term challenge: **speeding-up** GHG reductions

Source: EEA, Trends and projections in Europe 2016 — Tracking progress towards Europe's climate and energy targets.
Magic potions?
New paradigm - new normal

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Knowledge at the ‘half-way point’?

Is the current knowledge (system) adequate?
Where do we stand on critical knowledge developments?

- Systems theory; complexity theory
- Forward looking knowledge
- Meaning of ‘limits’ in conceptual understanding, research and practices?
- Re-inventing economics?
- Methodological innovation: Scenario’s, futures studies, for-casting, back-casting, distance to target, gap analysis, cost/benefit analysis 2.0, systems analysis
- Uncertainty, non-linearity, tipping points, ...
- Understanding of lock-ins, backlash, break-down risks

Are current academic education and research adapted, responsive, reflexive?
Research and societal relevance in a changing context

• Inter-, multi-, trans-disciplinary:
  – from academic (ir)relevance to standard practice?
  – transitional shifts in academic and research organisation

• Other type of innovations?
  – citizen science
  – empowerment, citizenship, actionable knowledge
  – co-creation, co-design

• Democratisation of science and knowledge?
Understanding rapid (systemic?) change?
Obesity Trends* Among U.S. Adults
BRFSS, 1985
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 1986
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 1987

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 1988
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 1989
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults

BRFSS, 1990

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 1991
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)

No Data           <10%          10%–14% 15%–19%
Obesity Trends* Among U.S. Adults
BFSS, 1992
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 1993
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults

BRFSS, 1994

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults

BRFSS, 1995

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Obesity Trends* Among U.S. Adults
BRFSS, 1996
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Obesity Trends* Among U.S. Adults
BRFSS, 2001
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 2002

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 2003
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 2004
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Obesity Trends* Among U.S. Adults
BRFSS, 2005

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Obesity Trends* Among U.S. Adults
BRFSS, 2007
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BRFSS, 2008

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Obesity Trends* Among U.S. Adults
BRFSS, 2009

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults

BRFSS, 2010

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
BRFSS, 1990, 2000, 2010
(*BMI ≥30, or about 30 lbs. overweight for 5’4” person)
Thank you

Hans.Bruyninckx@eea.europa.eu

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